Disaster Management, Climate Change and Variability and Social Resilience

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This has been a wonderful and rewarding experience. It has been a journey that has taken me to places I may never have envisaged. I would like to thank all those who have been involved in the journey, to those with whom I have discussed a range of issues from different perspectives and those with whom I have shared knowledge and experience. I believe without the involvement much of this would not have been possible.

Central to this work has been the support of my wife, Siobhan, and our four daughters, Colleen, Kate, Siobhan and Roisin, who have shown incredible patience and offered unconditional support. Without this, I believe I would never have reached this point.

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Personal Statement

I regard my professional life as divided into four separate phases. Firstly, after graduation as a certified electrical engineer, I worked on and off shore in the oil and gas industry for some 15 years. Secondly, on return to the North East, I undertook an MBA (Masters of Business Administration) at Durham University with the intention of starting a green business. In fact, the first formal job opportunity that arose was a senior lectureship, funded by a Department of Trade and Industry (DTI) scheme to develop training expertise, focused on energy and pollution reduction, that could assist SMEs (Small and Medium Sized Enterprises) in the North East of England improve their environmental performance.

This initial grant I transformed into a European Development Fund programme of some £250,000 that essentially drove the third phase of my professional life. This I regard as having a number of linked components. The first was a programme of empirical research into the activities of SMEs in the region that resulted in the publication of twenty case studies, the development and publication of training materials for SMEs in the EU, the development of guidance aimed at helping SMEs in a former Comecon country meet EU environmental standards and the development of global guidelines for technology transfer north to south.

After the completion of this phase I commenced what I term the fourth phase. At this point, though my teaching load increased at Northumbria, I was also able, with a number of colleagues, to enter a competitive process to gain funding of £400,000 to establish an interdisciplinary research group within the university. Initial thinking coalesced around sustainable development but it took some time to establish what I viewed as a coherent research focus. Cities, particularly in the developed world, are intensive resources users and waste producers and can be argued as primarily responsible for interference with the global ecosystem, for example the production of greenhouse gases. Getting behind the rhetoric of sustainable development, an increasingly common term in policy discourses we viewed as being an important starting point. Understanding how sustainable development was interpreted and used in policy making could help us to evaluate the effectiveness of policy initiatives. The application was successful and in 1999, the Sustainable Cities Research Institute (SCRI) was established. I shared my

time between teaching and the institute and it was during this period that I started to formulate some of the ideas that are a part of this submission. I became involved in the Disaster and Development Centre from 2002 onwards where I focused on disaster risk reduction. It is from my work within these bodies that I began to synthesise the ideas that form the basis of this submission for a doctorate by publication. Essentially the submission draws from published work from 2002 onwards, but incorporates aspects from earlier work. It is this fourth phase work that I am submitting for examination.

In parallel with this professional life, I enjoy a public life as an elected local authority member (Labour) on Newcastle City Council. From that position, in both control and in opposition, I have overseen practical energy and environment programmes. One of my most challenging experiences has been with Newcastle New Deal for Communities. I, and many others, have laboured (and continue to do so) to build the capacity of local people so they can have more control over their lives and regeneration of the area where they live. One would imagine that with the endowments of a developed world city, this would be fairly straightforward. It is not. It has been, and still is, challenging. It is feisty, argumentative and often chaotic. It has been a wonderful learning experience. Inevitably, though not directly, I have drawn on much I have learned from this and other experiences in public life.

Geoff O'Brien
March 2008

Disaster Management, Climate Change and Variability and Social Resilience

Abstract

Accelerated climate change and increasing climate variability caused by increasing anthropogenic greenhouse gas emissions is the single largest threat to the international goals of sustainable development, the Millennium Development Goals (MDGs) and disaster risk reduction. Global discourses recognise the need for effective and sustainable responses to produced climate risks. The risk types likely to occur are known, but only in broad terms. That they are produced by human action is accepted; but their scale, severity, longevity and frequency are not known. The challenge for policymakers is developing an effective framework within which sustainable responses can be formulated. Addressing the problems of produced risks requires a comprehensive approach to risk management to be effective. The mechanisms within the climate change, sustainable development and disaster risk reduction discourses are not sufficiently effective or integrated to respond to this challenge. Fundamental reform to current modes of risk reduction is needed, but this can only be achieved by a shift in the dominant perspective on formulating sustainable responses. This requires a shift to an enabling policy framework that encourages bottom-up resilient responses. Resilience is argued as a tool for policy development that can enhance adaptive capacity to current climate risks and shape energy policy to respond to mitigate future climate risks.

Keywords

Climate Change and Variability; Disaster Management; Resilience; Vulnerability; Sustainable Development; Risk

Introduction

Accelerated climate change and increasing climate variability presents very serious global risks that demand an urgent global response (Stern, 2006). The risk types likely to occur are known, but only in broad terms. That they are produced by human action is accepted (IPCC, 2007). But their scale, severity, longevity and frequency are not known. The risks generated by climate change and increasing variability can be termed 'produced unknowns', driven by human actions and, at this juncture, with unknown outcomes.

Produced unknowns are a category of 'wicked problems' where answers are incomplete, contradictory and set against changing requirements (Richey, 2007). There are no direct solutions to the problems of produced unknowns. But there are approaches that can build effective responses to produced unknowns. That shift is to a focus on preparedness which requires recognition of the need for change and a change in mindset and behaviour. It is the nature of the shifts and the principles needed to shape the process that are evaluated in this submission.

The threat to global welfare is real and there is recognition within the sustainable development, climate change and risk reduction discourses of their common interest in risk reduction. What is lacking is a unifying conceptual approach. This submission is a journey through these discourses that initially was focused on developing a unifying concept, namely resilience. In the course of that journey and drawing from both the developed and developing worlds, this submission finds that conceptually resilience can be used as tool for policy development for effective and comprehensive responses to produced unknowns. Resilience is not argued as paradigm but as tool or common reference point. Conceptually, resilience can be used to develop a set of principles for building responses to produced unknowns. Adaptation is the starting point for this process. The journey to that point is documented in the papers that form this submission. These are shown in Table 1 and numbered 1 through 7 and grouped under 3 headings; Sustainable Development, Climate Change and Energy and Disaster Management and Resilience. This grouping identifies which papers contain the key arguments related to the themes in this submission.

Table 1: Refereed Articles

Theme	Paper
Sustainable Development	**Paper 1:** Giddings, B. Hopwood, W. O'Brien, G. (2002) Environment, Economy and Society: Fitting them together into Sustainable Development, *Sustainable Development*, Vol. 10 pp 187–196. John Wiley & Sons, Ltd and ERP Environment, UK. **Paper 2:** Hopwood, W. Mellor, M. O'Brien, G. (2005) Sustainable Development: Mapping Different Approaches, *Sustainable Development*, Vol. 13, pp 38-52. John Wiley & Sons, Ltd and ERP Environment, UK.
Climate Change and Energy	**Paper 3:** O'Brien, G. O'Keefe, P. Rose, J. Wisner, B. (2006) Climate Change and Disaster Management, *Disasters,* 30 (1) pp 64-80. Blackwell, UK. **Paper 4:** O'Brien, G. O'Keefe, P. (2006) The future of nuclear power in Europe: a response, *International Journal of Environmental Studies*, Vol 63 pp 121-130. Routledge, Taylor and Francis, UK. **Paper 5**: O'Brien, G. O'Keefe P. Rose J. (2007) Energy, Poverty and Governance, *International Journal of Environmental Studies,* Vol. 64 (5) pp 607–618. Routledge, Taylor and Francis, UK
Disaster Management and Resilience	**Paper 6**: O'Brien, G. Read, P. (2005) Future UK Emergency Management: New Wine, Old Skin*? Disaster Prevention and Management*, Vol. 14(3) pp 353-361. Emerald, UK. **Paper 7:** O'Brien, G. (2006), UK Emergency Preparedness – A step in the right direction? *Journal of International Affairs*, Vol. 59 (2) pp 63 – 85. Columbia University, New York, USA.

Collectively the papers identify key barriers to the effective integration of sustainable development, climate change and disaster risk reduction. Papers 1 and 2 argue that the dominant interpretation of sustainable development militates against change, or significant change. Adaptation and mitigation within the climate convention are

current and future risk reduction strategies. Papers 3, 4 and 5 argue that adaptation is too narrowly focused and that mitigation at the scale required is unlikely with the current approach to energy system development. There is a danger that existing vulnerabilities in the energy system will be compounded. Papers 6 and 7 argue that resilience within disaster management has an institutional focus and Paper 3 evaluates how existing approaches to disaster management do not fit well with either adaptation or mitigation. The principles for shaping policy development for responding to produced unknowns are drawn from these papers.

Claim to Originality

This submission makes a claim to originality in that there are three problem areas of climate change, energy futures and disaster management that focus on sustainability, where current discourses deliver weak technical solutions, principally because technical solutions are superimposed on local communities. As such, in all cases, they cannot deal with the variability of extreme events. Extreme events associated with climate change are increased flood and drought. Within energy it is system failure related to either technical faults or geopolitical disruptions. Within disaster management it is the increasing severity and frequency of weather related events that overwhelm institutional capacity. Common to all three problem areas is that they do not see community capacity as an essential resource in planning for known, but unknowable, futures. As a consequence, this submission explores in the three problem areas the concept of resilience in a social, not an ecological, science sense.

Conceptually the term resilience implies an ability to resist and recover from disruptive events. This submission develops a method for the interrelated problems areas of climate change, energy futures and disaster management for embedding resilience within the policymaking process. The method is based upon an analysis of each area that concludes that current modes of policymaking are dominated by a top-down technocratic discourse that fails to listen to other voices. In that sense there is little meaningful dialogue and the rich array of approaches to effective resilience building are often overlooked. The findings of this analysis are presented in the papers that make up this submission. This appraisal paper then develops from this analysis a number of principles that can be used as tools in embedding resilience within the policymaking process.

The importance of the principles is that policymaking for an unknowable future cannot be focused on solutions. Simply put it is not possible to devise a solution to something unknown. The focus of policymaking ought to be on preparedness. This requires a process of building-up as opposed to policy making from the top-down. Imposed policy often amplifies and compounds existing vulnerabilities. For example, in an increasingly uncertain world, made even more so by the difficulties in agreeing a greenhouse gas concentration level to stabilise the climate system within an agreed timetable, extreme events will increasingly degrade livelihoods; the ability of the disaster management community to respond will be increasingly challenged. Resilience building in this context is a process that recognises preparedness as an essential prerequisite to cope with increasing variability and extreme events and adjust to a different future. In that sense resilience building is seen as a process that is built on entitlements and has at its core the notion of governance. Resilience building is a negotiated process and one that applies equally to the three problem areas of climate change, energy futures and disaster management. This requires a significant shift in political culture, a move to an enabling policy environment that actively encourages resilience building.

Methodology

The methodology that lies behind this submission is three-fold. The first, demonstrated particularly in this submission, is a methodology of programme evaluation to inform policy decision-making. The second methodology implied by the submission, but not demonstrated directly in the papers themselves, is the detailed evidence-based work on which the papers have been built through time. The third methodological approach is an exploration of my professional and public life which helps to triangulate between the first two groups of methods.

The papers presented in this submission encapsulate a critical evaluation of literature, drawn from academia, official sources and policy papers, from a realist perspective. A multi-tiered approach has been adopted to allow interrogation on a number of levels. The interrogation process has also drawn from real-world experience of the investigator as outlined earlier in this submission.

Evaluation is a formal process to interrogate policy delivery. The OECD: DAC (Organisation for Economic Cooperation and Development: Development Assistance Committee) uses five criteria for evaluation of development projects but slightly

changes these criteria for emergency projects. The five criteria are relevance, impact, efficiency, effectiveness and sustainability (OECD, 1992). In addressing these questions OECD: DAC argues that the issues of relevance, impact and sustainability have to be asked from a social perspective, whereas efficiency and effectiveness are respectively questions asked from the viewpoint of the implementers and the target group. As such this submission focuses on relevance, impact and sustainable issues that surround notions of resilience. The methodological difficulties that face such an evaluation are:-

- That relevance is difficult to judge because of the lack of consensus regarding needs and priorities.

- That impact is difficult to measure because of the lack of information of affected parties and, cause and effect.

- Questions of sustainability, necessarily embracing a future tense are frequently hypothetical answers to awkward questions.

Table 2 contains a summary of this argument where the criteria for disaster management are contained in brackets. In disaster management sustainability is substituted by the 4 Cs of Coverage, Coherence, Coordination and Connectedness together with the criteria of Timeliness. With reference to the social science focus on resilience the important emergency criteria from a social perspective are Coverage and Connectedness.

Table 2: Evaluation Approach

Criteria	What to Measure	Whose Perspective	Methodological Challenge	Key Questions
Measuring Relevance (Coverage)	Appropriateness in relation to policies, needs and priorities	The society	Lack of consensus regarding needs and priorities	Are objectives in keeping with needs and priorities? Should activities be continued or terminated?
Measuring Impact	Intended and unintended positive and negative effects	The society	Lack of information about affected parties. Cause and effect linkages	What are the positive and negative effects? Do positive effects outweigh negative effects?
Measuring Efficiency (Timeliness)	The delivery of aid	The implementers	What standards to use as reference	To what degree have aid components been delivered as agreed? Could it have been done cheaper, more quickly, and with better quality?
Measuring Effectiveness (Coherence) (Coordination)	Achievement of objectives	The target group	Unclear, multiple, confounding, or changing objectives	To what extent have agreed objectives been reached? Are activities sufficient to realise agreed objectives?
Measuring Sustainability (Connectedness)	Likelihood of benefits to continue	The society	Hypothetical answers	To which extent does the positive impact justify investments? Are the involved parties willing and able to keep design and exit strategy?

Source: Adapted from OECD: DAC, 1992

This first set of methodological tools for evaluation are ones that inform the published pieces in this submission but, in turn, they rely on a second methodology of positivist empirical science that underpins the policy conclusions. The empirical work is based

upon a number of large-scale publicly tendered contract research undertakings.[1] For example in sustainable development this work included detailed analysis of Small and Medium Sized Enterprises (SMEs) in the Tyne and Wear region that focused on improving the efficiency and effectiveness of their energy and environmental management systems. The sample case load was sixty SMEs, of which twenty were selected for presentation as final case studies.[2] This empirical work was driven forward through SCRI on a number of fronts including project work in waste, energy and spatial planning.

Another series of energy systems and climate change programmes are currently run as contract research for the Netherlands Foreign Ministry. The focus of this work has been on vulnerability to extreme events, coupled with an exploration of technical and social adaptations. The study is ongoing in fourteen countries and the first empirical results of these studies are contained in the reportage of the 1016 household surveys conducted in Tanzania across 2007. Details are contained in O'Brien et al 2008. Other ongoing empirical work of a technical nature is the production of a substantially different and updated version of The Future of Energy Use, due for publication in 2009 (Hill et al, 1995).

Empirical work in disaster management has focused directly on improved resilience following the introduction of the Civil Contingencies Act in 2004. This work has largely focused on the changing roles of the Emergency Response Service, especially the Fire Service, as they are now required to take a wider humanitarian role into account, including a wider view of vulnerability that logically leads to a discussion of resilience. This work also includes a more focused research effort on a UK-Japanese comparison of disaster risk futures in formal school curricula.

It is on the basis of these empirical studies, the second strand of the methodological approach of this submission, that argues for policy and programme conclusions that

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[1] Energy and Waste Audits, Newcastle International Airport; EU Leonardo projects in energy and waste management and environmental management systems; European Social Fund (ESF) projects on Cleaner Production; Energy and the Urban Environment study with particular reference to traffic impacts for Newcastle City Council; Greening the Supply Chain - an evaluation of the environmental performance of SMEs in the supply chain of a Local Authority.

[2] European Regional Development Fund North East England Objective 2 Programme, 316/201/3 - Project Team/Project Tyneside Waste Minimisation Initiative

seek to highlight the importance of community resilience, quite simply because, in all cases, there is:-

- No evidence that a single technology can resolve the problem.

- Ample evidence that single technological solutions lead to the problem of gigantism and top- down distribution systems that are inherently vulnerable.

- An alternative approach, built around local resources, including the human resource of the community itself, which seems to offer better scope for building resilience.

The third methodology which triangulates the evaluative methodologies outlined in this submission and the empirical evidence on which that policy debate is built as outlined in the second methodology, is the personal statement contained in this submission. In one sense this is a history of my professional and public life which respectively represents my technical and policy management work. Life history is growing and gaining acceptance as a standard method in social science research. It is not a dogmatic phenomenology but a method to capture the influences in a subjective policy world that are not necessarily accessible to standard methods of enquiry. In itself, this life history is built upon my own diaries and letters which mark an ongoing engagement in technical issues viewed from a community perspective. Sometimes, as with my engagement with regeneration of the inner west of Newcastle, these diaries and letters show that all technical decisions can be protracted ones, particularly if the rules of local governance remain unclear. It is this exploration of the multi-layered nature of governance that ultimately drives my exploration of resilience.

Conceptualising the Argument

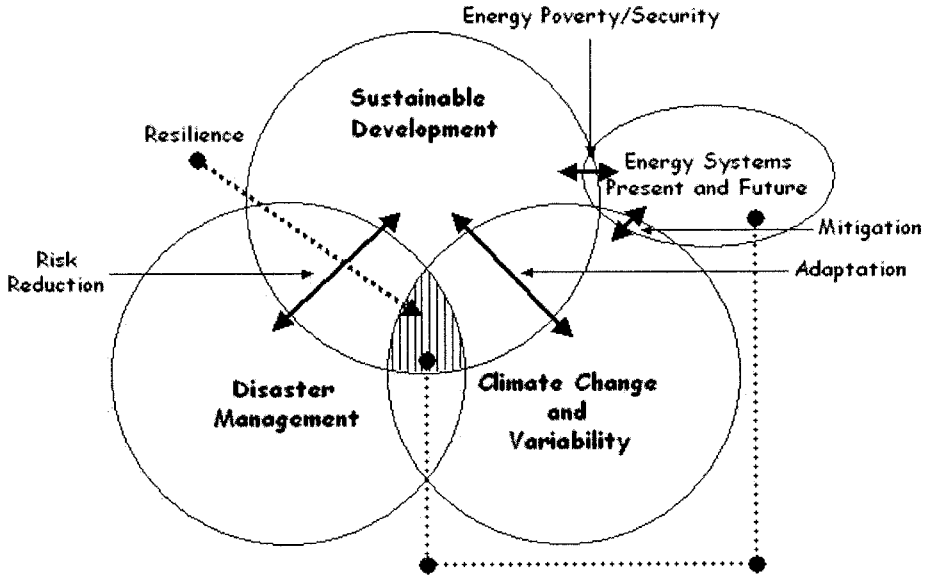
Addressing climate change should be an integral part of sustainable development policies, as should disaster risk reduction. This is not yet the case. However, a common feature of the sustainable development, climate change and disaster risk reduction discourses is doing things differently or change. Change is advocated as being purposeful and promoting positive outcomes, for example, to the energy system to mitigate climate change and within sustainable development to enhance human well-being. This argues that it is desirable to develop an approach that provides a bridge among disaster management, sustainable human development and climate change mitigation and adaptation. Change can often be disruptive and, in such complex areas, there may be fundamental barriers that do not allow, or militate against, change. Conceptually, resilience best captures the process of purposeful change in challenging circumstances, as at its core resilience expresses the ability to respond to and recover from disruptive challenges. In geography resilience was first addressed with reference to land systems (Blaikie and Brookfield, 1987). The resilience perspective as a response to disruptive challenges or contextual change has emerged as a characteristic of complex and dynamic systems in a number of disciplines including ecology, (Holling, 1973), economics, (Arthur, 1990), sociology (Adger, 2000) and psychology (Bonnano, 2004). Resilience as a concept is increasingly used within the disaster management community as a metaphor both to describe responses of those affected as well as responding systems (Manyena, 2006). A resilient system responds and adjusts in ways that do not harm or jeopardise function. Resilience is not a science, it is a process, using human capacity and ingenuity to mitigate vulnerabilities and reduce risks, both of which are socially constructed. Resilience has its focus on resources and adaptive capacity and acts as a counter, or antidote, to vulnerability (Paper 3:71).

Though the concept of resilience is articulated in all three discourses, it is defined within the disaster risk reduction discourse. The United Nations International Strategy for Disaster Reduction (UN/ISDR) defines resilience as:-

> *The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures.*
> (UN/ISDR, 2004, Annexe 1)

This definition does not advocate a solution or outcome but a process of learning and change. Conceptually resilience is seen as the overlap between the three discourses as shown in Figure 1.

FIGURE 1: Conceptualising Resilience



Resilience is not argued as a fixed concept but as process. The shaded area in Figure 1 can be seen as the resilience 'tool-box' where actors from different discourses are able to draw on the principles established in this submission for policy development. There is also an implicit feedback mechanism. None of the discourses are static and actors can feedback their learning and experiences of what works and why.

Resilience building enhances adaptive capacity through learning that enables positive responses to change; a proactive as opposed to a reactive approach. There is knowledge of this process, but only at a small-scale. Scaling-up is an urgent priority, but local governance structures, in the main, are designed to deliver top-down solutions, not encourage bottom-up engagement. Within the technological context of mitigation, resilience building argues a different structural approach to energy system development, one that is not wholly source and transmission focused, but has the capacity to adapt to new sources while meeting the objectives of improving energy security and reducing energy poverty. The challenge is not a lack

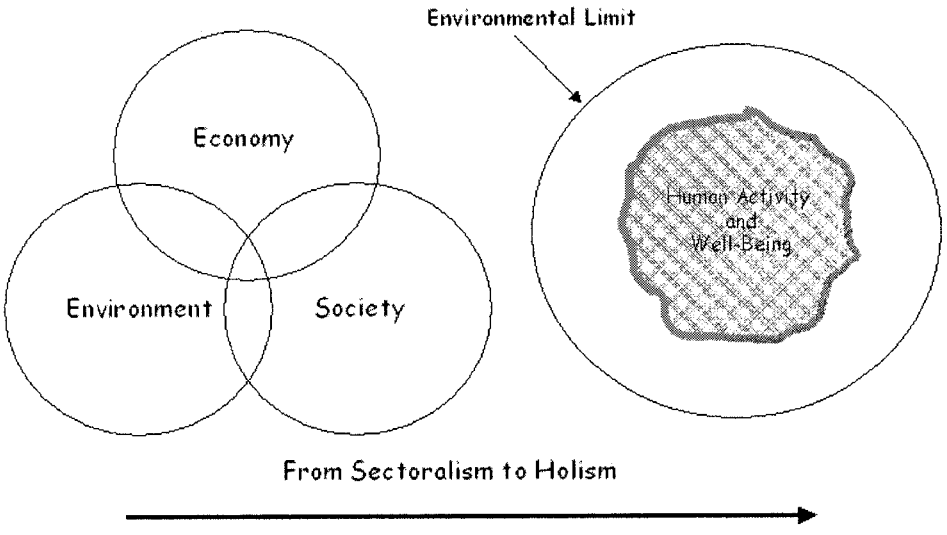
of technological know-how but whether or not there is sufficient political will for purposeful interventions that would shift the focus of energy system development.

Though resilience, conceptually, is being argued within the sustainable development, disaster risk reduction and, more recently, the climate adaptation discourses, there is little evidence of meaningful progress. There is clear need for a policy framework built on developing resilient social responses to cope with future challenges. Resilience, as a bridge building tool between the discourses, requires an enabling framework that encourages bottom-up responses. A focus on building the capacity of people, communities and the systems that support human well-being are needed. What is lacking is a clear, cohesive and comprehensive framework for resilience building. The starting point for analysing this problem is within the sustainable development dialogue.

Sustainable Development

Sustainable development is a contested concept, with theories shaped by people's and organisations' different worldviews, which in turn influence how issues are formulated and actions proposed. Diagrammatically in Figure 2, it is presented as the intersection between environment, society and economy, which are conceived of as separate, although connected, entities and presented as being of equal scale and presumably importance. In reality these are not unified entities: rather they are fractured and multi-layered and can be considered at different spatial levels. The market economy is often given priority in policies and the environment is viewed as separate from people. They are however interconnected, with the economy dependent on society and both dependent on, and within, the environment. The separation of environment, society and economy often leads to a narrow techno-scientific approach, while issues to do with society that are most likely to challenge the present socio-economic structure are often marginalized, in particular the sustainability of communities and the maintenance of cultural diversity.

Figure 2: From Sectoralism to Holism



Source: Adapted from Paper 1

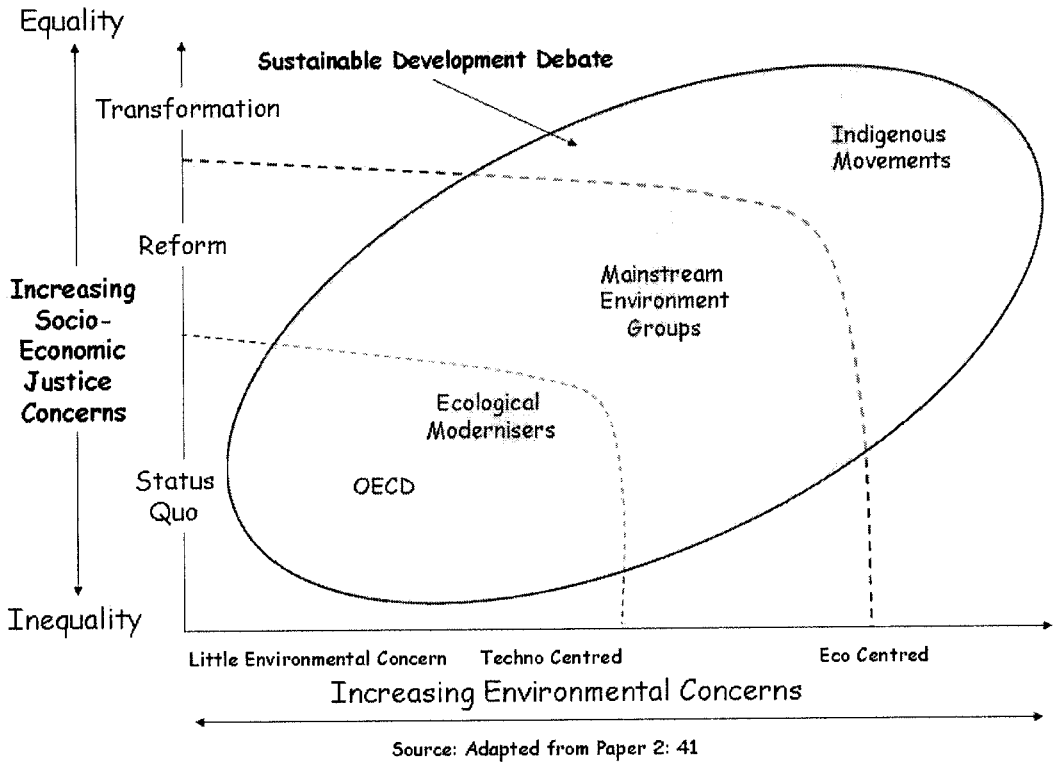
The arguments underpinning Figure 2 are elaborated in Paper 1 and were developed from research into sustainable development policy making. Paper 2 took this work further and established a number of principles to guide policy making to ensure a holistic approach to sustainable development would be realised. The principles determined are:-

- futurity: regard for the needs of future generations;
- equity: covering social justice regardless of class, gender, race, faith or origin;
- participation: concern that people are able to shape their own futures, and
- environment: respect for biodiversity and ecosystem integrity.

Paper 2 points out that, in reality, policy development is often single sector focused. For example, many activities in the energy sector ignore up and down stream impacts; although holistic methods such as life cycle assessment are available, they are often cited as being too costly or time consuming. Checklist or appraisal methods to ensure the sustainability of projects or developments only offer a veneer rather than a solid surface for development. Criticising such inadequate methods is not a rejection of the concept of sustainable development. It is the interpretation and consequent impact on policy development and implementation that is of concern.

There are three broad levels of interpretation of sustainable development: status quo, reform and transformation. These are illustrated in Figure 3.

Figure 3: Mapping Sustainable Development



Source: Adapted from Paper 2: 41

Within the sustainable development debate, the most powerful voices are those of the OECD (Organisation for Economic Cooperation and Development); essentially it is the developed world. Status Quo, with some minor changes, is the predominant

view. Given the power and wealth of the developed world, its influence in shaping global discourses cannot be overlooked (Paper 2).

Reform and transformation do have powerful advocates. Reform covers a wide range of people but is largely dominated by academics and mainstream NGO (Non-Governmental Organisations) experts. Reformists argue that large shifts in policy and lifestyle, many very profound, will be needed at some point, but assume that they can be achieved within present social and economic structures, the key being to persuade governments and international organizations, mainly by reasoned argument, to introduce the needed major reforms. They focus on technology, good science and information, modifications to the market and reform of government with themes such as de-materialisation, dramatic increases in energy efficiency and a shift to renewables which are argued as has having wider economic and social benefits as well as protecting the environment.

Transformation sees mounting problems in the environment and/or society as rooted in fundamental features of society today and how people interrelate and relate with the environment. Those within the sustainable development debate, mainly from the environmental justice and indigenous environmental movements, see the fundamental problems as rooted in our present society, which is based on the exploitation of most people and the environment by a small minority of people.

The Status Quo advocates within the developed world can argue, with some justification, that they have considerable experience and expertise in formulating solutions to environmental problems. This is the case, but the drivers have been a response to the consequences of technological development and market standards as opposed to a deep-rooted concern for the environment. The focus of policy development has been risk reduction usually technologically focused. It is only more recently that policy with a stronger environmental stance has emerged. This shift is largely driven by the increased wealth of the developed world enabling concern for impacts on well-being (quality of life) to be factored into policy development, a phenomenon where income inequality first increases and then declines with economic growth, postulated by Simon Kuznets in the 1950s and later applied to the environment (Grossman and Krueger, 1995). Underpinning the developed world approach to environmental management are strong links to market based approaches. For example, ecological modernisation originating in the 1980s has evolved from a de-materialisation agenda to one that incorporates social and

institutional change but still favours market-based approaches and incremental change as opposed to purposeful interventions (Paper 2: 42). Emerging from this are a suite of measures, collectively termed New Environmental Policy Instruments (NEPIs), aimed at influencing behaviours, driven by market-based measures.

Paper 2 concludes that a marketised approach clearly shows that economic concerns are dominant and that status quo is the principal interpretation of sustainable development within the developed world. As opposed to holistic and anticipatory approaches to environmental challenges, national frameworks in the developed world continue to evolve in a reactive manner. Given the influence of the developed world model of development, then arguably the industrialising nations will follow a similar pattern.

In summary the pre-dominant approach to sustainable development is governed by economic considerations and develops incrementally in response to perceived concerns. Solutions are dominated by technology, often without sufficient recognition of technology as the cause of the problem. This is a weak approach to sustainable development and does not bode well as an international template. The following discussion elaborates in more detail how this impacts both adaptation and mitigation strategies in addressing climate risk.

Climate Change

The United Nations Framework Convention on Climate Change (UNFCCC) approaches climate risk reduction from two perspectives; first, mitigation or reduction of greenhouse gas emissions to stabilise concentration at a safe level; second, adaptation, or adjustment to, climate driven change. Mitigation aims to reduce future climate risk. Adaptation aims to reduce current climate risk. Mitigation as a strategy has dominated the climate debate, whilst adaptation has received, comparatively, less attention.

The objective of UNFCCC is to stabilise greenhouse concentration at a level that would prevent dangerous anthropogenic interference with the climate system. This gave a strong focus on reducing future risks by limiting or mitigating greenhouse gases. Adapting to the consequences of climate change, though recognised by the Convention, lacked a similar focus. Article 4.8, the basis for negotiations on adaptation, refers both to the needs and concerns of developing countries vulnerable to climate change and to the adverse effects of climate protection measures on oil exporting countries (UNFCC, 1992). This link between those countries vulnerable to the effects of climate change and those vulnerable to impact of climate responses effectively prevented meaningful progress on adaptation.

The drive to obtain a Protocol, eventually realised as the Kyoto Protocol, is not the only reason behind the focus on mitigation. Funding for the Convention comes primarily from the North, principally OECD countries, as does funding for the scientific community responsible for producing the evidence base and the prediction models. Though differentiated responsibilities in terms of current emission levels are accepted, the responsibility for historic emissions, and who should pay, has been contested. There are fears that giving way in this area could lead to significant financial costs for OECD countries. The focus on mitigation is not surprising and, similarly, the focus on technological solutions. The dominant OECD world-view has clearly steered the way in which the Convention addresses the climate problem. This explains the focus on technological solutions and technology transfer and incremental target driven change. Despite this apparent unified Northern approach, cracks have appeared. The most obvious was the refusal of the USA to ratify the Kyoto Protocol, a clear example of its economic interpretation of sustainable development and the desire to retain the status quo.

The Third Assessment Report (TAR) by IPCC (Intergovernmental Panel on Climate Change) gave further credibility to the view that climate change was accelerated by human actions and that there was evidence of change occurring, gave new impetus to adaptation (IPCC, 2001). The Delhi Ministerial Declaration on Climate Change and Sustainable Development recognised adaptation as a high priority, not just for LDCs (Least Developed Countries) and Small Island States, but for all countries (COP8, 2002). Though this promoted the role of adaptation, the reality is that the signatories to the Convention faced significant problems and dilemmas as illustrated in Table 3. Despite TAR some countries, notably the USA, remained sceptical. If climate change proved to be false, or perhaps not as serious as some suggested, then the considerable costs of mitigation and adaptation could have significant negative economic consequences. This helps to explain the reluctance, and eventual refusal, of the USA to ratify the Kyoto Protocol, as its use of the argument that committing to greenhouse gas reductions could harm its economy clearly indicates adherence to a status quo interpretation of sustainable development.

Table 3: Decision Grid

	Shift needed for real change → 2	
Climate Change	**Taking Decisive Action**	**Taking Little or No Action**
True	✓	Global Catastrophe
False	Incurs high costs resulting in global economic depression	✓

Shift in views ↑ 1

Though TAR did bring about a shift in views of many Convention signatories as shown by arrow 1, the Fourth Assessment Report has brought about a global consensus that a real shift is needed as shown in arrow 2 (IPCC, 2007). The culmination of this is the Bali Roadmap agreed at COP 13 (Convention of the Parties) (UNFCCC, 2007). This is the first hesitant step to finding a successor to the Kyoto

Protocol, but more importantly it signifies a global consensus of the need to fight climate change. The key areas in the Bali Roadmap are recognition that deep cuts in global emissions are needed to avoid dangerous climate change, measures to enhance forests, support for urgent implementation of adaptation measures for poorer nations along with disaster risk reduction measures and consideration of methods for removing obstacles and the provision of financial and other incentives for scaling up the transfer of clean technologies. A more detailed agreement is expected for the 2009 UN summit in Copenhagen. The following discusses approaches to adaptation and mitigation needed to meet those objectives.

Adaptation

Adaptation has not received as much attention within the climate convention as mitigation. The Delhi Declaration and arguably recent events such as the 2003 European heat-wave and hurricane Katrina have given impetus to the adaptation discourse. The challenge has been, and still is, how to plan effective adaptation responses. Internationally adaptation efforts have been an irregularly funded patchwork of multilateral and bilateral initiatives as opposed to being purposeful and cohesive (Burton et al, 2006). In many developed countries adaptation studies have been dominated by assessment of future climatic changes and impacts with the discussion on adaptation limited to a few generic options with little attention paid to vulnerability (Gagnon-Lebrun and Agrawala, 2006). In general they have tended to be top-down and expert led.

Effective adaptation requires a broad response. Adaptation is not a new concept. Societies have adjusted continually throughout human existence. Adaptation is not defined in the Convention but is defined by IPCC in its Third Assessment Report as:-

> *Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation*
> (IPCC, 2001)

This identifies a number of types of adaptation, but from a policy development perspective adaptation measures need to be purposeful. Adaptation is a risk reduction strategy, meaning that it is best placed within a comprehensive risk

management framework (Paper 3: 69). Climate change is a multifaceted (from drought to flood) and multidimensional (from local to global) hazard that has short-, medium- and long-term aspects and unknown outcomes that require a systematic and comprehensive approach. Direct responses to produced unknowns cannot be formulated, but preparedness strategies to expected risk categories can be developed. Of interest to policymakers is the nature of the planning process. Climate impacts are felt at the local level meaning that adaptation is, in fundamental ways, inherently local. For responses to be robust, or even possible, they must be formulated within an enabling framework. They must be guided and supported by national policies and strategies. For poorer countries they need to be facilitated through international measures.

Though the aim of adaptation is to reduce or mitigate vulnerability, its focus is on adaptive capacity. Adaptive capacity refers to the potential or ability of a system, region, or community to adapt to the effects or impacts of climate change (Smit and Wandell, 2006). Adaptive capacity is the ability of a system to adjust to actual or expected climate stresses, or to cope with the consequences and IPCC defines adaptive capacity as being a function of determinants such as wealth, technology, education, information, skills, infrastructure, access to resources, and stability and management capabilities (IPCC, 2001). Wealthier nations have greater capacity than poorer nations, though adaptation responses have tended to be to be top-down and expert led. Experience with the Netherlands Climate Action Programme (NCAP) highlights a number of issues around approaches to adaptation in the developing world.[3] Micro-level projects can help to increase capacity and enhance societal resilience. However there can often be conflict with top-down national policies and programmes. Where national approaches to adaptation have been implemented, for example through National Adaptation Programmes of Action NAPA), the top-down sector approach can lead to conflict across sectors and with local initiatives. A simple example is agriculture where irrigation can reduce the risk of crop failure, but where increased water demand excludes other users and where smaller farmers cannot afford the adaptation technology. In short, implementing adaptive measures is complex and works best with a top-down enabling environment and effective communications at all levels (Thomalla *et al*, 2006).

[3] The author has been associated with this programme for a number of years. The programme works with 14 developing countries to develop adaptation response to climate change and increasing climate variability. See O'Brien G. (2006) Pre-Disaster Planning and Climate Change, Working Paper, NCAP in Appendix 8. Further detail on the NCAP programme is available at: http://www.nlcap.net/.

Adaptation needs to be part of comprehensive risk management (Paper 3). Successful risk management requires that the actors in the risk management chain remain in close proximity. This builds resilience. Distancing an actor weakens the chain, eroding resilience (Paper 7). Approaches to risk management in the developing world tend to be top-down and an important actor, the public, is often distanced in the risk management chain (Papers 6 & 7). This will be explored more fully later in this submission. In the developing world, externally funded programmes, often with pre-determined methods, can lead to sub-optimal solutions. An approach is needed that involves specific hazard and vulnerability assessments as well as the identification of coping capacities. In this case, the risk management chain needs to include the vulnerable and this emphasises the importance of community-based, participatory risk assessment when dealing with hazards (Paper 3).

Disaster management as currently practised is inadequate to the task of resilience building as part of preparedness for produced unknowns. Humanitarian responses have a needs based approach with the longer term role of recovery typically the responsibility of other organisations (Paper 3: 67). The natural hazard and technological model of disaster management for natural and technological disasters is more focused on response to rapid onset disasters as opposed to slow onset problems caused by a changing climate (Paper 3: 69).

Disaster reduction has emerged as a core element of sustainable development (Hyogo, 2005). The problem with disaster management as currently practised is the dislocation within the risk management chain. Response organisations are often too internally focused with little recognition of the longer-term recovery process and recovery processes are often disconnected from those affected by disasters. There is a need both locally and globally to strengthen the risk management chain. Locally this means involving people in planning for risk reduction and globally ensuring that institutions that share a risk reduction perspective collaborate more closely. Adaptation as a risk reduction response to produced unknowns requires closer collaboration between the climate and disaster management communities. Paper 3 argues the case for closer collaboration and cooperation between the UNFCCC and UN/ISDR as in reality both institutions have similar aims and objectives; namely to reduce risk. But doing so requires a different approach and perspective on risk management and an equal focus on mitigation and adaptation. There has recently been some progress in this area, with a cooperation agreement between UNFCCC and UN/ISDR.

The Bali Roadmap calls for enhanced action on adaptation and the need to give consideration to "....ways to enable climate-resilient development and reduce vulnerability of all Parties....." (UNFCCC: Decision 1/CP13:4, 2007). This is welcome. Risk management needs to be part of climate change efforts. There are likely to be difficult political choices such as planned retreats. The developed world should have sufficient capacity but there are issues around the institutional focus of disaster management. Learning how to cope in a changing world may well require reform. For the developing world the focus will have to shift from one of relief to one of resilience that will enable communities to help themselves (Paper 3: 76). Both are a considerable challenge.

Mitigation

All countries need access to clean, affordable and reliable energy services that do not exacerbate climate change risks. In the developed world access defines quality of life while in the developing world lack of access constrains development.[4] To make any progress towards achieving the Millennium Development Goals (MDGs) requires a new approach to energy systems for poorer nations. Equally, innovative thinking is needed to shape future energy policy in the developed and industrializing worlds (Paper 5). Global discourses on energy futures are primarily focused on mitigation and much of the discourse is supply-side focused. Energy system development is entering a supply-constrained era (Gupta et al, 2007). Geopolitical disruptions will add to existing system vulnerabilities. This places constraints on system development as security concerns require a shift to indigenous resources and climate concerns are driving a shift to low carbon and renewable resources. Supply-side issues are important but should not be viewed in isolation. The discourse should focus on re-thinking energy systems from both supply and demand perspectives. Future energy systems should contribute to sustainable development. There are many uncertainties for energy system development such as price volatility driven by increased demand and a diminishing fossil fuel resource, geopolitical disturbances and the scale and timing of mitigation measures to avoid dangerous climate change. A resilience perspective can shape system development so that it is able to more effectively respond to such disruptive challenges.

[4] Though energy poverty is a social concern for many developed world economies, the issue here is that energy poverty acts as an economic development block in poor countries. This is expressed in O'Brien, G. and O'Keefe, P. (2006) Energy, Poverty, Climate Change: The Way Forward, *EASE* (Enabling Access to Sustainable Energy) Vol 3 in Appendix 9)

Papers 4 and 5 approach this from two different, but related, perspectives. Paper 4 questions the top-down supply side focus in the developed world, the dominant model. Paper 5 examines the problem of energy poverty in the developing world and concludes that there are lessons to be learned that can be applied in the developed world.

Energy Poverty

Conventional approaches to energy system development, for example, large-scale interconnected electrical grid systems, are unlikely to meet the needs of many people, particularly those of the poorest. Worldwide, nearly 2.4 billion people use traditional biomass fuels for cooking and nearly 1.6 billion people do not have access to electricity. By 2030 there is a risk that another 1.4 billion people will be in the same position (IEA, 2002). Modi et al (2006) argue the need to scale up the availability of affordable and sustainable energy systems. While there is little dissent from this view, this does raise questions about the pattern of future energy system development. The dimensions of the challenge for the energy system can be summarised as:-

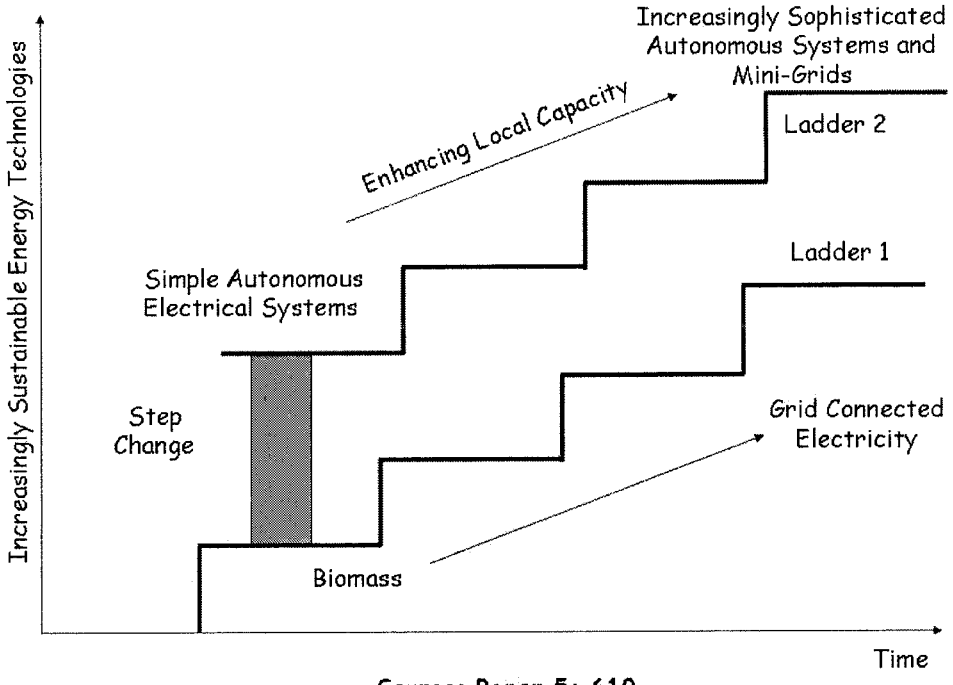
1) No adverse interference with the global climate system.
2) Wherever possible using indigenous resources to minimize geo-political risks.
3) Appropriate to needs and long-lasting.
4) Work within the context of the environment.
(Paper 4: 125)

These dimensions apply globally. The scale of the challenge is huge and technologically sophisticated nations have experienced difficulties just in meeting climate obligations. For example in the EU initial assumptions that energy consumption could be reduced proved to be unfounded. Though some emission reductions were made, these were achieved through fuel substitution and structural changes, as opposed to real reductions in demand (Dunn, 2002). These reductions were quickly surpassed by growth in the domestic and transport sectors reflecting significant lifestyle changes. The drive for greater efficiency in generation, transmission, distribution and end-use has also been offset by demand growth.

The Kyoto mechanisms, established to encourage technology transfer to the industrialising and developing world to aid development of sustainable energy systems, have instead become the developed world vehicle for meeting the modest reduction targets of the Protocol (Paper 5). Part of the problem is the design of the mechanisms, for example the CDM (Clean Development Mechanism) provides monetary incentives for mitigation and none for sustainable energy system development in the host (Ellis et al, 2007). This form of mechanism for technology transfer is unlikely to effectively address energy poverty in the developing world.

Addressing energy poverty requires a specific focus and one that is based on needs. Addressing sustainable development goals requires the use of low carbon and renewable resources and system development that enhances capacity. The burden on the poor, particularly women, is discussed in Paper 5. Simply progressing up the existing energy ladder will not address energy poverty effectively, as Ladder 1 in Figure 4 is predicated on the dominant model of progression (Paper 5).

Figure 4: Alternative Energy Ladder Approaches



Source: Paper 5: 610

A new trajectory that focuses of the development of autonomous systems using indigenous resources, Ladder 2, offers the opportunity to enhance capacity. The Step Change shown in Figure 4 assumes the introduction of renewable technologies. This

is not a simple technology transfer. The starting point is assessment of needs, resources and availability of support system before an entry point can be defined (Paper 5: 611). This is a negotiated process where the technology producers would not dominate the specification process.

Drawing from case studies of small-scale electrical systems, Paper 5 sets out the dimensions and characteristics for sustainable energy systems (Paper 5: 612). Each step up the energy ladder will enhance capacity of the users. This embeds resilience. Resilience is a function of resources and capacity. Resources are defined as the livelihood capitals (human, social, natural, physical and financial). Sustainable energy systems are predicated on the availability of natural resources. Enhancing the capacity to operate, maintain and improve the system over time is a social learning process. It is also an institutional learning process that requires technology producers and support organisations to approach energy poverty and energy system development differently. But as evidenced earlier current technology transfer mechanisms militate against this approach. Change is needed and Paper 5 concludes by suggesting that by assigning a greater value to the Carbon Emission Reductions (CERs) generated by such projects may encourage more sustainable approaches.

The Bali Roadmap, agreed at COP 13 (Conference of the Parties) acknowledged that there are barriers to effective technology transfer and initiated a process to review mechanisms to remove obstacles, provide advice to developing countries and develop financial incentives for scaling-up the transfer of clean technologies (UNFCCC, 2007). This is welcome.

Learning the Lessons

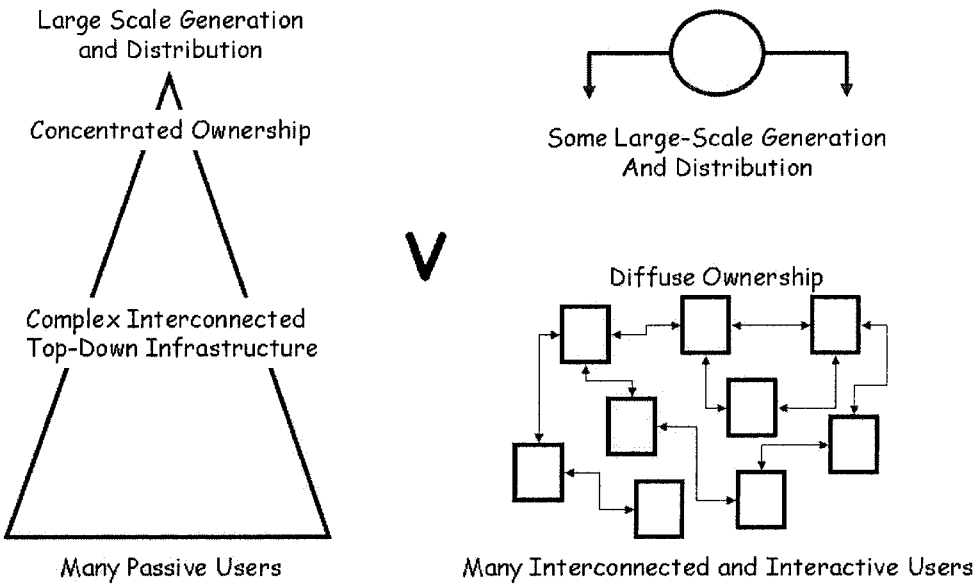
There are a number of lessons that can be applied to help shape the direction of energy systems in the developed world. The dominant energy model is technically complex and capital intensive and has inherent technical vulnerabilities (Perrow, 1999; Lovins and Lovins, 1982). These are being compounded by geopolitical uncertainties of security of supply and more recently by instrumental threats (Paper 4).

Renewable resources are diffuse and intermittent and usually have lower energy densities. As opposed to supply on demand, a renewable approach requires

"capture-when-available" and "store-until-required" strategies. There are exceptions, such as hydro-electric schemes, but typically renewable systems function best at small-scales near to point of use. They are not focused on a particular fuel type but use indigenous resources (Paper 5). Though a renewable approach is vulnerable to source intermittency, its does not have the same system vulnerabilities associated with the dominant model. For example top-down interconnected electrical systems are vulnerable to cascading faults, a regular occurrence in Europe and North America. Small-scale and distributed systems can be interconnected but the direction is typically horizontal, a structure not prone to cascading faults. Use of indigenous resources minimises geopolitical risks.

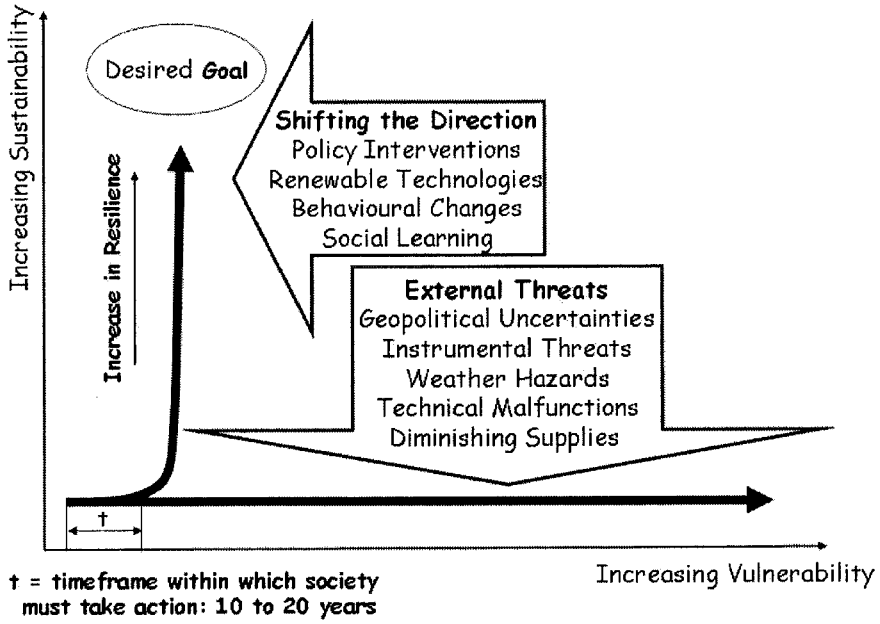
There are examples of deployment of renewable systems in the developed world but their focus is on ensuring the efficiency of end-use. The EU estimates that at least 20% of energy is wasted through inefficiencies (EU, 2006). Buildings, for example, use 40% of energy in the EU (EU Action Plan on Energy Efficiency, 2006). There are numerous studies that show that efficient appliances and design can drastically cut energy use (Boardman, 2007, IEA, 2003, EST, 2006, DEFRA, 2007, PEP, 2006). By installing renewable capacity to produce heat and electricity the built environment can act as a generator. This implies a very different structure to the current system as shown in Figure 5.

Figure 5: Contrasting Models of Energy System Structure



As Figure 5 suggests there is considerable mix of scales but recognises that large scale systems do have a role to play. But what is clear is that technological innovations are driving the development of smaller and more flexible energy technologies and users are increasingly using them driven by fears of the vulnerability of sensitive systems to power failure interruptions or prolonged failure (Paper 5). As Table 1 (Paper 4: 126) indicates there are many renewable technologies and new technologies are being developed and it is possible that a new energy carrier such hydrogen will become commonplace. The question however is what is needed to shift the direction of energy system development to a more sustainable basis as shown in Figure 6.

Figure 6: Shifting the Direction



Without a shift in public attitudes towards the environment then technology cannot solve the interrelated problems of energy and climate change (IEA, 2003). Addressing energy system development requires purposeful intervention to guide the development as well as re-connection of the user with the energy system. Where such interventions have been used the results have been impressive (Paper 4:127). Reconnecting users encourages active participation in tackling the problems we face. This is best realised in a top-down enabling environment that encourages bottom-up innovation. This embeds resilience.

In summary the speed and scale of adaptation of the dominant model to renewable resources will determine the effectiveness of mitigation. This will require considerable re-structuring, investment and time. But the signs are not encouraging. Energy policy proposals in the EU advocate a market-led EU-wide interconnected system (EU Commission, 2007). The UK has recently decided to develop new nuclear capacity. Both developments indicate that energy thinking is still locked by the status quo interpretation of sustainable development.

Disaster Management

The core theme of this submission is that resilience building is the most effective way of responding to produced unknowns. To respond to current and ongoing risks requires building resilience into adaptation and disaster response and preparedness platforms. The Hyogo Declaration of the United Nations International Strategy for Disaster Reduction (UN/ISDR) recognises the linkages between disaster risk reduction and sustainable development (UN/ISDR 2005). The Hyogo Framework for Action (HFA) posits resilience as a key attribute in building communities able to withstand and cope with adverse events. The starting point for resilience building is vulnerability (Hyogo, 2005).

Within the global discourses of reducing the risk of produced unknowns, resilience building, particularly for poorer and vulnerable communities, is seen as a means of helping them to help themselves. At the core of this discourse is recognition, though not stated, that in the event of multiple simultaneous disaster occurrences, response capacity would be overwhelmed. The international disaster community has called for resilience building along with the establishment of disaster management platforms. The focus of the disaster management is risk reduction of all hazard categories; a generic or "all-hazards" approach (Quarantelli, 1992; Sikich, 1993; Alexander, 2005). This generic approach is a feature of disaster management in the developed world and is effectively the dominant model. There is a considerable literature describing this approach to disaster management. It can be characterised as legally based, professionally staffed, well funded and organised. It aims for a return to normality, that is, to re-establish conditions as they were prior to the event (Perry and Peterson 1999; Alexander, 2000, 2003; Schaafstal et al 2001; Paton and Jackson 2002; Cassidy 2002; Perry and Lindell 2003). Table 4 has been derived from an analysis of the reform of UK disaster management in Paper 6 and typifies the dominant model. Though resilience and preparedness are embedded within the terminology of the dominant model (Paper 6: 354) the reality is that the focus is on institutional resilience and preparedness. This top-down structure is incompatible with the notion of resilience building.

Table 4: Technocratic Model of Disaster Management

Dominant Paradigm	Comment
Isolated event	Disasters usually regarded as unusual or unique events that can exceed coping capacity
Risk not normal	Risk is socially constructed and risk management aims to reduce risk to within proscribed levels realised through governance structures
Techno-legal	The legislative framework, regulatory system and the technologies used for risk reduction and disaster response
Centralized	Realised through a formal system such as a government department or state funded agency
Low accountability	Typically internalised
Post event planning	Internal procedure for updating and validating plans based on lessons learned
Status Quo restored	The overall aim – a return to normal

Source: Adapted from Paper 6

Recently the approach in Europe and North America towards disaster management has been skewed towards a securitisation agenda stemming from the September 11th 2001 terrorist attacks in the USA and the London (2005) and Madrid (2004) bomb attacks (Papers 6 and 7). It is the duty of government to protect the public. But too great an emphasis on one source of threat can divert attention, both of government and the wider public, from other pressing problems. The current focus and emphasis needs to change to reflect the wider agenda of preparedness. It is this aspect of raising awareness, public education and risk communication that is lacking in the way the dominant model is typically practised. In the UK, for example, little has been done in this respect (Paper 6: 359). In terms of the risk management chain an important actor, the public, has been distanced. This is the antithesis of resilience building.

Linking Disaster Management and Adaptation

Effective preparedness is a partnership between government strategies and individual and societal behaviours (Berman and Redlener, 2006). Effective preparedness is the key to resilience building. Essential to effective resilience building is an enabling environment that assigns local communities an active role as agents of change in their own right such as assessing priorities, scrutinizing values, formulating policies and carrying out programmes (Sen, 2005).

Applying this rationale more broadly to disaster policy response to climate change is dependent on a number of factors, such as institutional and social capacity and willingness to embed climate change risk assessment and management in development strategies. These conditions do not yet exist universally. Reducing vulnerability is a key aspect of reducing climate change risk. To do so requires a new approach to climate change risk and a change in institutional structures and relationships (Paper 3). A focus on development that neglects to enhance governance and resilience as a prerequisite for managing climate change risks will, in all likelihood, do little to reduce vulnerability to those risks.

Where there has been a willingness to re-think responses to disastrous events the results have been positive. For example storms in 1970 and 1991 in Bangladesh resulted in deaths of 500,000 and 138,000 respectively. Following the 1970 disaster, the government along with agencies initiated the Bangladesh Cyclone Preparedness Programme, a bottom-up programme aimed at reducing the vulnerability of communities and resilience building through social learning processes. This strengthened the self-help capacities based on indigenous knowledge of vulnerabilities and using participatory methods to develop programmes such as community training in disaster preparedness (Yodmani, 2001). This exhibits willingness at the institutional level to undertake a new approach and to learn from experience. This is institutional learning. Examples of the measures implemented are Early Warning Systems, evacuation procedures and shelter provision. In the 1991 cyclone fatality rates were 3.4 percent in areas with access to cyclone shelters compared to 40 percent in areas without access to shelters. Because of improved preparedness during another strong storm in 1994, three quarters of a million people were safely evacuated and only 127 died (Schultz et al, 2005; Akhand, 2003).

Institutional learning explores how learning takes place in response to changing conditions. There are two forms of learning that are applicable to disaster management; single-loop and double-loop (Argyris and Schon, 1996). Single-loop learning or adaptation is the adaptation of new knowledge to existing frameworks of objectives and causal beliefs. In essence, this is learning to do something better. Double-loop learning includes single loop learning but also questions the framework of beliefs, norms and objectives. It is about re-thinking the way things are done.

Single-loop learning is a predominant characteristic of disaster management within the developed world (Papers 6 and 7). Whilst this embeds resilience within the disaster management function and acts to improve response capability and institutional capacity, there is a danger that this internal focus will not challenge culturally accepted beliefs, associated precautionary norms set out in laws or codes of practice and custom and practice. Failure to make these changes contributes to disasters (Turner and Pidgeon, 1977).

Learning can change the way in which responses to threats are constructed. Adaptation to current and ongoing climate risks can be more effectively developed within an enabling framework that recognises that local knowledge of vulnerabilities is the starting point for developing effective responses. Resilience building not only strengthens self-help capacity to respond to threats but also the capacity to plan for and undertake changes that will reduce risks. Planning prior to disaster occurrence can use adaptation to construct an effective response paradigm. This is illustrated in Table 5.

Table 5: Characterising Adaptation as Disaster Risk Reduction

Adaptation Paradigm	Comment
Part of development	Adaptation is not an add-on but should be an integral part of societal development
Risk of disaster is an everyday condition	Climate change and variability is a known category of natural hazards amplified and accelerated by anthropogenic activities that will occur
Social capacity	Enhancing the ability of societies to both respond to hazards and adjust to change
Participatory	Learning to enhance capacity
Transparent	Undertaken in an enabling environment
Pre disaster plans	Aimed at prevention
Transformation	Move society to a new set of conditions – enhance coping capacity and improve baseline condition, for example, decrease levels of poverty

Source: Adapted from Paper 7: 75

Constructing a global response model to the challenges of adaptation that embeds resilience argues for both top-down and bottom-up perspectives. The starting point for planning adaptation responses is vulnerability. Embedding resilience argues for a pre-disaster focus to ensure that effective responses are developed and that societies are able to adjust to change and recover from disruption.

Adaptation will be challenging. It is a long-term and costly process likely to result in disruption, for example, the relocation of people and infrastructure away from hazardous areas. In terms of scale adaptation requires decisions from individuals, firms and civil society, to public bodies and governments at local, regional and national scales. Building adaptive capacity will include communicating climate change information, building awareness of potential impacts, maintaining well-being, protecting property or land, maintaining economic growth, or exploiting new opportunities. Table 6 brings together those aspects of the dominant and adaptation paradigms and develops a set of principles for adaptation planning and resilience building.

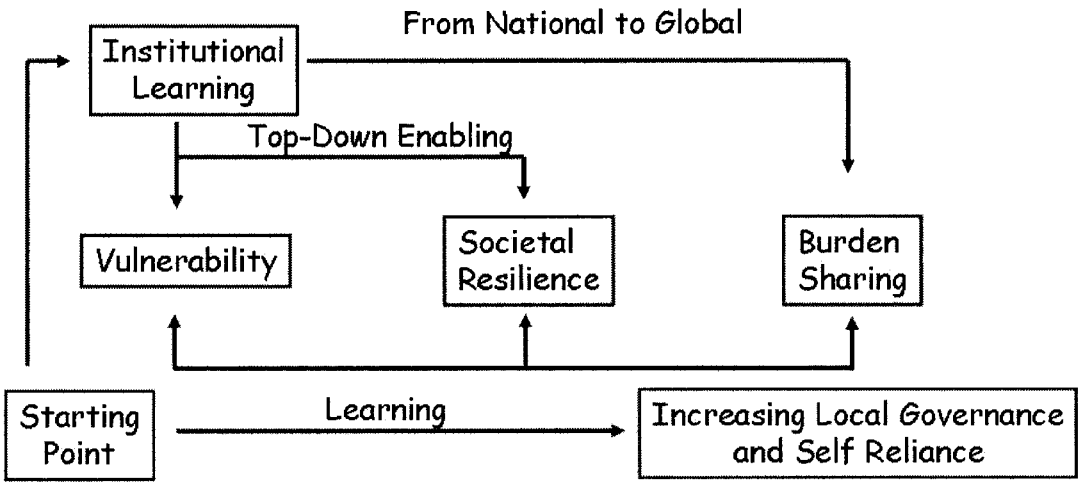
Table 6: Pre-Disaster Planning Principles for Adaptation

Pre-Disaster Planning Principles	Comment
Sustainable Development	An approach that focuses on reducing risk both now and in the future
Risk Avoidance	Developments should be evaluated from a risk reduction perspective
Embedded in Policy and Practices	Adaptation should be normalised
Distributed to the appropriate level	It is both top down and bottom up
Shared responsibility	The basis for renewing the preparedness partnership between government and people
Learning from scientific evidence, indigenous knowledge and experience	All knowledge is important, but of equal importance is effective communication and dissemination
Adjusting to changes	A recognition that the future may be very different
Organisational and Social Learning	Thinking differently and learning about how we approach problems related to adaptation should be the norm

Source: Adapted from O'Brien, 2006

Failing to build a meaningful global response to climate change risks an unbalanced global response (Paper 3). Figure 7 illustrates that linking vulnerability, societal resilience and burden-sharing provides a framework for learning at all levels that has the potential to lead to a fair and equitable climate agreement.

Figure 7: Linking Concepts for Climate Risk Reduction



Concluding Comments

There is a considerable evidence base that disaster risk is increasing and impacting the most vulnerable (Paper 3). However the democratic nature of climate change and variability means that all populations throughout the world will be impacted in one way or another. Adaptation to the consequences of climate change and variability is an urgent priority for public policy. The challenge for public policy is on many levels; nationally within the developed world to develop sustainable responses; within the developing world to enhance institutional and social capacity for disaster risk reduction; and for the international community to ensure that developmental policies are aimed at working to meet internationally agreed goals both for poverty reduction and climate risk reduction.

The agreement between UN/ISDR and UNFCCC to collaborate is welcome. Though there are concerns about the appropriateness of the dominant model of disaster management as an appropriate vehicle for resilience building, recent changes in UK government thinking in the National Security Strategy, indicate the potential for positive change (BBC, 2008). The new approach involves improving local resilience, building and strengthening local capacity and engaging households in preparedness strategies. This is the right rhetoric and is welcome. The challenge will be turning the rhetoric into reality.

The beginning of this submission described the process of trying to identify a unifying concept in the discourses on sustainable development, disaster risk reduction and climate change as a journey. As with many journeys, some do not end and some take new directions. The latter has occurred in preparing this submission and has resulted in two further publications on response to climate change. The first publication has its focus on UK responses to climate change and analyses changes needed to move UK disaster management to a more external focus as a step towards social resilience building.[5] The change of approach announced in the UK National Security Strategy offers the opportunity to explore in more depth how we can build holistic responses to future challenges. The second publication examines the problems of adaptation in the developing world and finds that adaptation strategies can often work against traditional coping strategies. Because of poverty,

[5] O'Brien G., 2008, UK Emergency Preparedness – A Holistic Response? *Disaster Prevention and Management*, Vol 17 (2). Emerald UK

poorer nations are least able to adapt and efforts to adapt to climate change must address poverty.[6]

This brings the discussion back to the energy problem. The UK and the EU have committed to a low carbon future, but there are concerns about how this will be realised. Building resilience into the energy system is a challenging process but there is much that can be learned from small-scale systems in the developing world. Resilience building within the energy system, though focused on future risk avoidance, follows the same principles as resilience building for adaptation. It is a function of resources and adaptive capacity. Endowments are variable and arguably the developed world with its technological and financial capacity and skills-base should have little difficulty embedding resilience. But resilience building within the energy system requires purposeful interventions that are directed at developing sustainable solutions. This is in the political domain. Energy system development must address energy poverty. Energy poverty is just one dimension of poverty for many countries. The principles of sustainable development commits those involved with the energy system to develop sustainable responses. The Bali Roadmap acknowledges that technology transfer requires a different approach. Energy system development must build on endowments. Paper 5 argues that there is much we can learn from small-scale developments in the developing world. The first lesson is that solutions must be negotiated, not imposed. Without the active engagement of the public and leadership by the public sector, it is difficult to envisage how a low carbon future will be realised. Technology transfer is not confined to country-to-country or developed-to-developing world exchanges. It is about transferring technology and control to the most appropriate level. Technology transfer is about building resilience and strengthening governance. Access to clean, affordable and sustainable energy services is an entitlement for all people. This is an issue that policymakers must take into account for future energy system development.

This submission has argued that responding to produced unknowns driven by a changing climate requires resilience building. Resilience building is needed in pre-disaster planning and sustainable development to develop the social and institutional capacity to respond to produced unknowns. Resilience is argued as process that aims to reduce harm, both now and in the future. The focus of resilience is on well-being. Resilience building is a learning process at all levels. Institutional learning

[6] O'Brien G. O'Keefe P, Meena H. Rose J. Wilson L., 2008, *Climate Adaptation from a Poverty Perspective,* Climate Policy, Vol 8 (2) Earthscan

empowers at the local level and strengthens governance. This is negotiation not imposition. Responding to the threat of produced unknowns require both current and future strategies. Strategies are needed to adapt to disruptive challenges generated by a changing climate. Strategies are needed to shape energy policy to minimise future risks. Resilience recognises that there is no steady-state or end result. It is process without end that has, at its core, the notions of entitlements and governance.

Conclusion

From these concluding remarks it is quite apparent that there is a substantial way to go before there is a resilient planning framework for sustainable development, energy systems and disaster management. There is sufficient empirical evaluation from projects and sufficient evidence from the meta-evaluations provided in this submission from which we can at least know the departure point and direction of travel. That direction of departure is from a base of thinking about resilience in a social science context where resilience may be more popularly defined as individual and community ability to mop-up and bounce back after extreme events that are deemed to be beyond the experience of every day life. Modern everyday life requires that we plan for an unknown future knowing that, at some time, it will happen. The drive must be to put the price to be paid for individual and community resilience into the planning process that matches the way the Polluter Pays Principle has been incorporated into environmental management. This, however, is no easy task, as it not simply an economic or financial consideration but a question of how we seek our entitlements to govern ourselves, including the governance of our own physical and social reproduction.

The body of work in this submission is sufficiently strong to point out the dual problem of the difficulties of:-

- Handling known unknowns.

- Building social structures of resilience.

But it is weak in relying essentially on communication theory to argue a way forward when such reliance is at best a partial solution. The real solution lies in addressing issues of governance. Central to the approach to governance must be the emphasis on a system that reduces social risk both in the present and in the future. Such a resilient approach has at its core the view that any production of nature or of society should be done from a risk reduction perspective. From such a perspective adaptation is not an *ex-post* response to actual extreme events, but is normalised in the planning process as a way of approaching known unknowns. Adaptation structure requires both top-down and bottom-up approaches which may be regarded respectively, as the deductive and inductive methods of resilient planning. There is no better example of the impasse in current systems thinking than that provided by

the Emergency Response Services, where the services themselves make resilient planning in their own communities, not in the communities at large, their paramount purpose. A parallel example for energy systems analysis is the uncritical acceptance of renewable energy technology *per se,* rather than a questioning analysis of what the ownership and governance structure of a renewable utility might look like – this is hardly progress if all solar energy production is owned by a monopoly or oligopoly of existing private power companies.

Solving the ecological and market challenge of sustainability is not progress either if in resolving these problems the solution denies or erodes local community entitlements. In short there is a need to both think and learn differently if we wish to build resilient communities and establish a critical but sustainable future.

We cannot risk our children's children.

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Appendix 1

Environment, Economy and Society:
Fitting them together into Sustainable Development.
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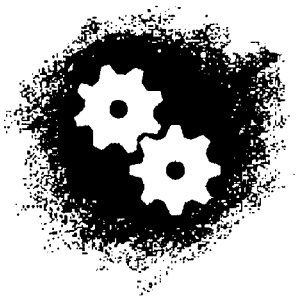
ENVIRONMENT, ECONOMY AND SOCIETY: FITTING THEM TOGETHER INTO SUSTAINABLE DEVELOPMENT



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Sustainable development is a contested concept, with theories shaped by people's and organizations' different worldviews, which in turn influence how issues are formulated and actions proposed. It is usually presented as the intersection between environment, society and economy, which are conceived of as separate although connected entities. We would argue that these are not unified entities: rather they are fractured and multi-layered and can be considered at different spatial levels. The economy is often given priority in policies and the environment is viewed as apart from humans. They are interconnected, with the economy dependent on society and the environment while human existence and society are dependent on, and within the environment. The separation of environment, society and economy often leads to a narrow techno-scientific approach, while issues to do with society that are most likely to challenge the present socio-economic structure are often marginalized, in particular the sustainability of communities and the maintenance of cultural diversity.

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SUSTAINABLE DEVELOPMENT: A CONTESTED CONCEPT

Sustainable development is a contested concept with a wide range of meanings. It is embraced by big business, governments, social reformers and environmental activists, all of which put their own interpretation on what sustainable development means.

After initial reluctance, 95% of large companies in Europe and the USA now believe that sustainable development is important (Little, undated). The World Economic Forum, in their modest words the 'world's leadership team', discusses sustainability, although giving it the WEF spin (WEF Forum, 2001). Over 150 of the world's major companies in mining, oil and gas, autos, chemicals, logging, banking and finance, cement, electricity generation, drugs and bio-technology are members of the World Business Council for Sustainable Development (WBCSD, 2001). New Labour

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(DETR, 1999), the Conservatives (HMSO, 1994) and the Liberal Democrats (2000) all support sustainable development. Many environmentalists including Friends of the Earth (2001) and Greenpeace (2001) are committed to sustainable development, while being critical of companies who are members of the WBCSD. Organizations and individuals with concerns about social issues while supporting sustainable development disagree with the outlook of businesses and international economic organizations. The Real World Coalition argues that the 'the path of globalisation... will not succeed in eliminating poverty; it will increase it' (Jacobs, 1996, p. 51). Companies who are members of WBCSD have been in conflict with trade unions and human rights activists (Rowell, 1996).

The classic definition of sustainable development, 'meeting the needs of present without compromising the ability of future generations to meet their needs', was produced by the Brundtland report (WCED, 1987). In many ways Brundtland was a political fudge (Middleton *et al.*, 1993, p. 16), based on an ambiguity of meaning (Wackernagel and Rees, 1996) in order to gain widespread acceptance. The combination of socio-economic concerns and environmental concerns was guaranteed to be a contest field as the long standing debates within both socio-economics and environmentalism flowed into sustainable development with the added debate over the relation between socio-economic and environmental issues.

As sustainable development is like 'motherhood and apple pie', in that it sounds so good everyone can agree with it whatever their own interpretation (Pearce *et al.*, 1989), this can be seen as a strength. Others argue (Workshop on Urban Sustainability, 2000) that the blandness of meaning makes the concept almost meaningless and it lacks any clear rigour of analysis or theoretical framework. It can be interpreted to mean almost anything that anyone wants, so that beneath its covers lies a multitude of sins. One option to the dilemma of meanings over sustainable development is to change the use of words to sustainability (O'Connor, 1994) or sustainable livelihoods (Workshop on Urban Sustainability, 2000). These phrases avoid some possible conflicts between economic growth, social equity and the environment and instead focus on human needs and the environment–what Brundtland claimed was the aim of sustainable development. Deep Ecologists reject the concept of sustainable development as it prioritizes the needs of humans, however conceived and defined, over the rest of life and largely views the environment from a human standpoint. Despite these problems, we have used the phrase sustainable development as it attempts to embrace the relation between the socio-economic and environmental and has gained widespread recognition.

It is clear from all the debates about sustainable development is that there is no common philosophy. There are so many interpretations of sustainable development that it is safe to say that there is no such thing as sustainable development-ism, in contrast to the schools of neo-liberalism, feminism, deep ecology or socialism. Rather, the existing worldviews of people and organizations flow into their conception of sustainable development (Hopwood *et al.*, in press). When examining an interpretation of sustainable development it is important to bear in mind the philosophy underlying the proponent's point of view. Concern with sustainable development, as with any other way of looking at the world, inevitably involves abstractions, which are themselves shaped by the observer's outlook. These underlying worldviews influence what are considered the main priorities and choices about what policies should be implemented and actions taken.

THREE SECTORS: ECONOMY, ENVIRONMENT AND SOCIETY

Sustainable development is often presented as being divided into the economy, environment

and society (Hardi and Zdan, 1997; West Midlands Round Table, 2000). The three sectors are often presented as three interconnected rings (ICLEI, 1996; du Plessis, 2000; Barton, 2000) (Figure 1). The model has a conceptual simplicity. By encouraging the classification of impacts into three convenient categories it makes analysis more straightforward. Often sustainable development is presented as aiming to bring the three together in a balanced way, reconciling conflicts. The model usually shows equal sized rings in a symmetrical interconnection, although there is no reason why this should be the case. If they are seen as separate, as the model implies, different perspectives can, and often do, give a greater priority to one or the other.

There are major weaknesses and limitations of this model. It assumes the separation and even autonomy of the economy, society and environment from each other. This view risks approaching and tackling issues of sustainable development in a compartmentalized manner. The separation distracts from or underplays the fundamental connections between the economy, society and the environment. It leads to assumptions that trade-offs can be made between the three sectors, in line with the views of weak sustainability that built capital can replace or substitute for natural resources and systems (Neumayer, 1999). This ignores the fact that no number of sawmills will substitute for a forest, no amount of genetic engineering can replace biodiversity and it would be an immense technical problem to construct a replacement for the ozone layer (Wackernagel and Rees, 1996).

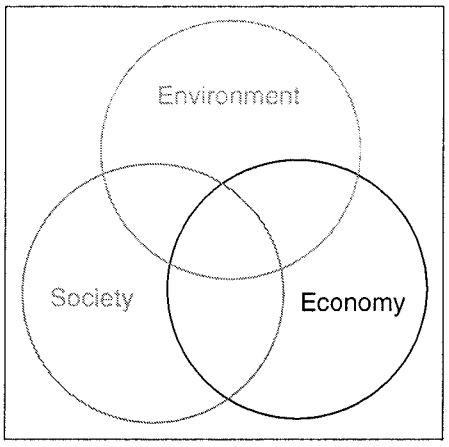

Figure 1. Common three-ring sector view of sustainable development

In most debates about sustainable development either the environment or the economy is given priority. Although the Local Agenda 21 agreements at the Rio Conference included issues to do with social and economic development, strengthening participation and means of implementation (Grubb, 1993), most LA 21 plans in Britain focus primarily on environmental issues (County Durham, 1997; Northumberland County, 2000). This concentration of LA21 on the environment can be a weakness, as this often means it is treated as peripheral by both local and national government, who usually concentrate on economic issues. Many English and American environmentalists give priority to issues of the countryside, wild animals and wilderness with the aim of preservation from people, with much less concern about the urban environment. This outlook has its roots both in a view that sees the environment as separate from humans and an anti-urban tradition.

One of the effects of the three sector separation is to encourage a technical fix approach to sustainable development issues. This focuses on pollution control, lower resource use and greenhouse gas trading rather than tackling the deeper issues or seeing the connections between society, economy and the environment. Technical solutions in the economy, such as changing interest rate, benefits or taxation are seen as ways to move the economy towards sustainable development. These are attractive to some as they can be introduced fairly quickly and do not involve a more fundamental examination of the relationship between the economy, society and the environment. A sectoral approach can divert attention from asking questions that are important to getting to the core of sustainable development such as those

about the nature of our society, what the policy priorities are, how decisions are made and in whose interest. The wider social issues often fall off the sustainable development agenda.

POLITICAL REALITY: PRIORITIZING THE ECONOMY

The reality of life today is that the economy dominates environment and society. The large global companies dominate decision making, including that of many governments (Korten, 1996; Monbiot, 2000). Also international forums and organizations, heavily influenced by the large corporations, take decisions without even the modest level of democratic control that exists on national governments. Whilst central government and business have embraced sustainable development, the separation into the three sectors can be used to justify a concentration on a part, rather that the whole. In most cases, governments' main concern is economic growth. Bill Clinton famously stated 'It's the economy stupid', not 'It's the quality of life' or 'It's people's happiness'. The British government's definition of sustainable development includes the aim of a 'high level of economic growth' (DETR, 1999). The growth of GDP is one of the key indicators to measure progress towards sustainable development. There is little or no concentration on an integrated approach or tackling deep-seated inequality in British society. In Britain and internationally, inequality in wealth, power and education is often justified on the grounds that it will aid economic growth, which in turn will raise everyone's living standards. This is in spite of the increase in inequality under the trickle down theory. As well as the increased inequality suffered by the poor, most people have not benefited from the growth in GDP as quality of life has become separated from economic growth. The Index of Sustainable Development for Britain (Jacobs, 1996), which measures human welfare and environmental issues, declined with the advent of neo-liberal economic policies from the 1970s to the 1990s almost back to the level of the 1950s. It is no surprise that during this time Prime Minister Thatcher infamously stated that 'There is no such thing as society'.

British urban policy has concentrated on economic and physical regeneration and less on environmental and social issues. Business has mainly concentrated on the economic benefits of resource and energy efficiency and the marketing opportunities of a 'green' image. All these views of sustainable development have concentrated on the development side of the concept and interpreted it as meaning growth as defined in standard neo-liberal economic terms. This focus on the economy is likely to increase with the advent of a recession.

Environmental economists talk of the environmental impacts of business such as pollution, damage to biodiversity and loss of attractive landscapes as unpaid costs or externalities. This begs the question of how or to what a company pays these costs. How does money compensate an animal for its loss of habitat or a tree for acid rain? In a similar way there are many social externalities that business does not pay for, such as unemployment, a loss of community and damage to health.

Normally when governments, businesses and some theoreticians talk about the economy, they mean the production and exchange of goods and services through the operation of the market. They are referring to the capitalist economy. They do not give equal consideration to the multitude of actions that provision people and satisfy their needs that take place outside the market, such as subsistence activity in many parts of the world, the helping of friends, much of the raising of children, household labour and social relationships. One of the trends of capitalism is to increasingly commodify the satisfying of human needs. As well as the production of material goods, capitalism is trying to turn knowledge, caring for people, entertainment and nature into commodities. Reflecting this change, human

relationships and the environment are increasingly described in economic terms, as being natural and social 'capital' and as providing 'services'–an extension of Marx's comment that capitalism reduces everything to the 'cash nexus'. Some (e.g. Pearce *et al.*, 1989) argue that putting a price on the environment, to internalize the externalities, will reduce environmental damage. Others (Mellor, 1992; Cock and Hopwood, 1996; Shiva, 1998) argue that the commodification of nature and increasing areas of human activity will move society further from sustainable development.

MATERIAL REALITY: NESTING ECONOMY IN SOCIETY AND ENVIRONMENT

Political reality gives primacy to the economy. This largely treats the environment and society as a resource to be exploited, both natural and human, and as a sink where problems are dumped, whether unemployment, ill health or waste. In contrast, the material reality is that the economy is dependent on society and the environment (Daly, 1992; Rees, 1995; Wackernagel and Rees, 1996).

Society embraces the multitude of human actions and interactions that make up human life. Without society, humans would not survive, as our very existence, in both evolutionary and present terms, is based on social interaction. Human activity takes place within the environment. Nearly all our actions have an impact on the environment. Human life itself depends on the environment. Our material needs, heat, light, food, medicines, clothing, as well as modern consumer goods are made with materials and energy that come from it. Products, regardless of whether they are described as waste or as goods, eventually end up returning into the environment. As well as satisfying needs, the environment provides the source of much of culture and leisure enjoyment. Much of art and spiritual beliefs and most of science and technology draws on the environment. While humans are capable of abstract thought, philosophy, planning, language and making tools, we are part of the natural world. The idea of our separation, whether rooted in religion or mis-applied concepts of evolution, is a human delusion of grandeur, which risks ever more disasters for humanity. Being part of nature we, like every other species, have unavoidable impacts on the environment. We should not dream of separation from the environment, rather work towards an interaction that will last, that is sustainable (Levins and Lewontin, 1994).

What is placed in the area described as the economy is a subset of society. Some human needs are met through the production of commodities; many are met by other activities that take place partly or wholly outside what is described as the economy (Langley and Mellor, 2002). The production and exchange of goods is a social relationship, dependent on many non-monetary activities. The developments that go to make up modern industry, business and technology are also products of human history, much of which is based on non-monetary activities. Even modern hi-tech sectors of the economy, such as pharmaceuticals, are often based on indigenous knowledge and the environment (Shiva, 1998). The economy part of the entire process is primarily the exploitation of these wider connections in time and space. It is an abstraction to conceive of the economy as a separate area of activity. Without society there can be no economy.

A more accurate presentation of the relationship between society, economy and environment than the usual three rings is of the economy nested within society, which in turn is nested within the environment (Figure 2). Placing the economy in the centre does not mean that it should be seen as the hub around which the other sectors and activities revolve. Rather it is a subset of the others and is dependent upon them. Human society depends on environment although in contrast the environment would continue without society (Lovelock, 1988). The economy depends on society and the

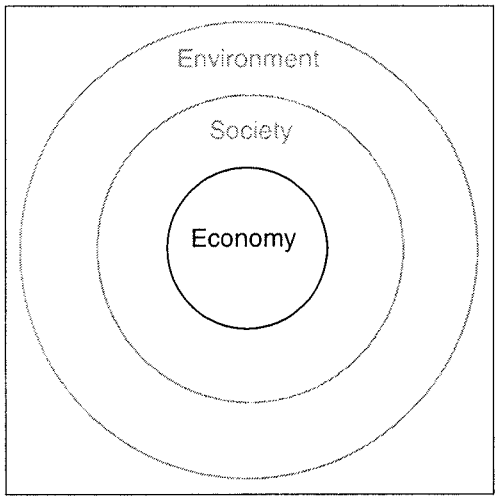

Figure 2. Nested sustainable development–the economy dependent on society and both dependent on the environment

environment although society for many people did and still does (although under siege) exist without the economy.

A key issue for sustainable development is the integration of different actions and sectors, taking a holistic view and overcoming barriers between disciplines. The 'nested' model rather than the 'three-ring' model encourages a conceptual outlook sympathetic to integration. Of course this again is a very broad-brush model. Most humans live their lives in all three areas, often without sharp distinctions in thought or practice.

MULTI-LAYERED AND MULTI-FACETED

Until now the three sectors have been considered as if there is an environment, an economy and a society; assuming that each sector is a unified entity. This, of course is a further abstraction. There are a multitude of environments, societies and economies. At different spatial scales different environments, economies or societies are apparent.

There are clear differences between the environments of the Antarctic ice sheet, a European forest and Mediterranean scrub. At a finer scale there is difference between a temperate oak forest and a boreal spruce forest. Even on a single tree there can be different environments. Similarly an insect and a fish may experience the same stretch of a stream differently, with a fish being influenced by gravity while an insect is more affected by surface tension. There is a complex connection and interaction between the local and the global.

Presenting society as a single entity gives precedence to the dominant society of official structures, ruling power relationships and western culture. In effect this hides, and therefore tends to ignore and discriminate against, other cultures. Even the phrase 'social exclusion' masks the real character of being excluded from the dominant economic and decision making structures. Many of the poor living on council estates have a strong society; it is often vital to coping with a lack of money and access to power structures.

Similarly, claiming there is a single economy underestimates or ignores non-monetary provisioning, the informal economy that many use to cope with poverty, the subsistence economies of many cultures and other sectors that are not the concern of the stock market, governments and the major world corporations and finance institutions. It reinforces the view that all the actions of meeting human needs should be based on the monetary economy and gives priority to the interests of the globalized sectors of the economy.

The effect of pretending that the economy and society are each a unified whole is to ignore diversity and difference and instead give precedence to the dominant parts. Just as in the environment, diversity is an important part of human sustainability (Jacobs, 1965). The changes in science, technology, art and culture are stimulated by diversity. Shiva (1998) points to how global capitalism exploits all forms of diversity for profit and while so doing risks destroying that very diversity, with dangerous consequences for people and the environment.

As well as there being different economies, societies and environments, depending on the spatial scale, all of these have changed and are changing over time. The abstraction into three unified entities underplays the constant change and reinforces the idea of a static world, in which the present dominant structures and priorities have always existed and will remain.

Although all theories or explanations of the world are based on simplification and abstraction, it is important to be aware of the limitations and dangers of such abstraction. The over-simplification into the three separate sectors of economy, environment and society risks ignoring the richness and multi-layeredness of reality; giving precedence to the present dominant economic and social relationships; seeing the economy as a separate part of human activity and thinking that human activity is separate from the environment. All of these are impediments to moving towards sustainable development.

CHANGE OF VIEWPOINT: BREAKING DOWN THE BOUNDARIES

Although the move from three rings to a nested view is a step forward, it still has limitations. An improvement would be to remove the separation of the economy from other human activities. This separation inflates the importance of the market, assumes it is autonomous and does not focus primarily on meeting of human needs whether by the market or other means. We would suggest that human activity and well being, both material and cultural, should be viewed as interconnected and within the environment. Humanity's well being depends on the environment, although we should recognize that the natural world, although it would change without humans, would survive without us. The same cannot be said for humanity. The boundary between the environment and human activity is itself not neat and sharp; rather it is fuzzy. There is a constant flow of materials and energy between human activities and the environment and both constantly interact with each other (Figure 3).

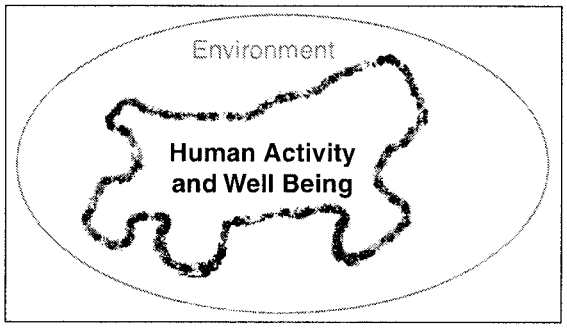

Figure 3. Breaking down boundaries: merging society and economy and opening up to the environment

One of many possible examples of the need for an integrated approach is issues of health. The WHO (1997) places 'health and sustainable development' at the centre of the three sector ring model. Health is affected by the economy–people's poverty, type of work or lack of it all have a major impact on health. Their social circumstances also have a major impact on health as does the quality of their immediate and wider environment (Acheson, 1998).

This shift would base sustainable development on an integrated view and reduce the theoretical justification for trade-offs between such features as poverty in society or depletion of resources against growth in GDP in the economy. Instead it would encourage a 'win–win' outlook, for example appreciating a shift to renewable energy can benefit the environment and human well being. Defining the aim as human well being would encourage seeing discrimination in any form as contrary to sustainable development, rather than as at present, as undesirable but justified by gains elsewhere. Instead of having a priority on the economy, which is a means to an end, the focus should be on human provisioning and satisfying needs, which may be done in many more ways than those described within economy.

Theories of sustainable development stress the need to take a 'whole systems' approach that appreciates emergent properties, complexity and interactions (Hardi and Zdan, 1997). These lead to the need for an integrated and holistic approach, using analogies with ecosystems rather than linear systems (Expert Group on the Urban Environment, 1996). As Lawrence (1996, p. 64) points out, sectoral concepts and approaches 'hinder the definition and application of integrated perspectives'.

PRINCIPLES OF SUSTAINABLE DEVELOPMENT

Even the redefinition of sustainable development to focus on human well being and removing the separation of economy and society as outlined above still has drawbacks. Nowhere are there clear ethical values or guidelines to indicate the basis for decisions or what are priorities. Sustainable development needs to be based on principles that would apply to all issues whether they are classified as environmental, social, economic or any mix of the three. Haughton (1999) outlines five equity principles:

(i) futurity–inter-generational equity;
(ii) social justice–intra-generational equity;
(iii) transfrontier responsibility–geographical equity;
(iv) procedural equity–people treated openly and fairly–and
(v) inter-species equity–importance of biodiversity.

As sustainable development principles for human relations these can be summarized as futurity to give regard for the needs of future generations; equity covering social justice regardless of class, gender, race, etc or where they live and participation so that people are able to shape their own futures. A principle recognizing the importance of biodiversity and ecosystem integrity is also vital.

These principles, futurity, equity, participation and importance of biodiversity, would move society beyond present approaches based on monetary cost/benefit analysis or a utilitarian view that can justify the suffering of some by the benefits of others. Averages can mask great inequality. A population of 100 people with every person receiving £20 000 has the same average as if one person has £1 million and the other 99 have £10 101 but one is much less equitable and therefore contrary to the principles of sustainable development.

Basing sustainable development on principles would mean that similar questions could be asked about any policy or action. Such questions might include the following: are benefits and losses shared fairly, now and in the future; is the quality of life improved and in an equitable manner; do people have an equal access to decision-making; do decision-makers carry responsibility for, and feel the effects of, their decisions; will the benefits last; does this protect or improve biodiversity; will this ecosystem continue into the future; will our children and grandchildren approve of the decisions and do the proposals encourage an integration of policies?

CONCLUSION: STANDING BACK TO MOVE FORWARD

The division of sustainable development into three separate sectors, environment, society and economy, which are only partially connected, does not produce an integrated or principle based outlook. This division reflects the common approach to the study and description of human life and the world around us, which is dominated by a multitude of separate disciplines. These are partly a product of the need for detailed study in an area, but also of the history of thought in our society.

This separation has been shaped by the alienation of much of human life from the environment we live in, as well as the separation between the production and consumption of

the means of life. To many people today, goods just appear in a shop and there is little or no awareness of where they came from or how they were made. At the other end of a product's life, it disappears into another unknown black box labelled waste. The philosophy of the separation of mind and body is a fundamental conception of alienation and of separation. Technology is often seen as separate from society yet it only exists within social and cultural relationships.

Sustainable development will require more than technical changes at the end of the pipe or modifications to cost/benefit analysis. It will need a shift in how humans see the world. Humans are part of a web of connections within what is called the environment and society. We cannot pretend to separate the impacts of our actions into distinct compartments. There is a need to overcome the barriers between disciplines to an interdisciplinary or even trans-disciplinary view of the world. Sustainable development, to have long-term meaning, will be an integrated and principle based outlook on human life and the world we live in.

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Appendix 2

Sustainable Development: Mapping Different Approaches.
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Sustainable Development: Mapping Different Approaches

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ABSTRACT
Sustainable development, although a widely used phrase and idea, has many different meanings and therefore provokes many different responses. In broad terms, the concept of sustainable development is an attempt to combine growing concerns about a range of environmental issues with socio-economic issues. To aid understanding of these different policies this paper presents a classification and mapping of different trends of thought on sustainable development, their political and policy frameworks and their attitudes towards change and means of change. Sustainable development has the potential to address fundamental challenges for humanity, now and into the future. However, to do this, it needs more clarity of meaning, concentrating on sustainable livelihoods and well-being rather than well-having, and long term environmental sustainability, which requires a strong basis in principles that link the social and environmental to human equity. Copyright © 2005 John Wiley & Sons, Ltd and ERP Environment.

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Sustainable Development: A Challenging and Contested Concept

THE WIDESPREAD RISE OF INTEREST IN, AND SUPPORT FOR, THE CONCEPT OF SUSTAINABLE development is potentially an important shift in understanding relationships of humanity with nature and between people. It is in contrast to the dominant outlook of the last couple of hundred years, especially in the 'North', that has been based on the view of the separation of the environment from socio-economic issues.

For most of the last couple of hundred years the environment has been largely seen as external to humanity, mostly to be used and exploited, with a few special areas preserved as wilderness or parks. Environmental problems were viewed mainly as local. On the whole the relationship between people and the environment was conceived as humanity's triumph over nature. This Promethean view (Dryzek, 1997) was that human knowledge and technology could overcome all obstacles including natural and environmental ones. This view was linked with the development of capitalism, the industrial revolution and modern science. As Bacon, one of the founders of modern science, put it, 'The world is made for

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man, not man for the world'. Environmental management and concern amongst most businesses and governments, apart from local problems and wilderness conservation, was at best based on natural resource management. A key example was the ideas of Pinchot in the USA (Dryzek, 1997), which recognized that humans do need natural resources and that these resources should be managed, rather than rapidly exploited, in order to ensure maximum long-term use.

Economics came to be the dominating issue of human relations with economic growth, defined by increasing production, as the main priority (Douthwaite, 1992). This was the seen as the key to humanity's well-being and, through growth, poverty would be overcome: as everyone floated higher those at the bottom would be raised out of poverty.

The concept of sustainable development is the result of the growing awareness of the global links between mounting environmental problems, socio-economic issues to do with poverty and inequality and concerns about a healthy future for humanity. It strongly links environmental and socio-economic issues. The first important use of the term was in 1980 in the World Conservation Strategy (IUCN *et al.*, 1980). This process of bringing together environmental and socio-economic questions was most famously expressed in the Brundtland Report's definition of sustainable development as meeting 'the needs of the present without compromising the ability of future generations to meet their needs' (WCED, 1987, p. 43). This defines needs from a human standpoint; as Lee (2000, p. 32) has argued, 'sustainable development is an unashamedly anthropocentric concept'.

Brundtland's definition and the ideas expressed in the report *Our Common Future* recognize the dependency of humans on the environment to meet needs and well-being in a much wider sense than merely exploiting resources: 'ecology and economy are becoming ever more interwoven – locally, regionally, nationally and globally' (WCED, 1987, p. 5). Rather than domination over nature our lives, activities and society are nested within the environment (Giddings *et al.*, 2002). The report stresses that humanity, whether in an industrialized or a rural subsistence society, depends for security and basic existence on the environment; the economy and our well-being now and in the future need the environment. It also points to the planetwide interconnections: environmental problems are not local but global, so that actions and impacts have to be considered internationally to avoid displacing problems from one area to another by actions such as releasing pollution that crosses boundaries, moving polluting industries to another location or using up more than an equitable share of the earth's resources (by an ecological footprint (Wackernagel and Rees, 1996) far in excess of the area inhabited). Environmental problems threaten people's health, livelihoods and lives and can cause wars and threaten future generations.

Sustainable development raises questions about the post-war claim, that still dominates much mainstream economic policy, that international prosperity and human well-being can be achieved through increased global trade and industry (Reid, 1995; Moffat, 1996; Sachs, 1999). It recognizes that past growth models have failed to eradicate poverty globally or within countries, 'no trends, ... no programmes or policies offer any real hope of narrowing the growing gap between rich and poor nations' (WCED, 1987, p. xi). This pattern of growth has also damaged the environment upon which we depend, with a 'downward spiral of poverty and environmental degradation' (WCED, 1987, p. xii). Brundtland, recognizing this failure, calls for a different form of growth, 'changing the quality of growth, meeting essential needs, merging environment and economics in decision making' (WCED, 1987, p. 49), with an emphasis on human development, participation in decisions and equity in benefits. The development proposed is a means to eradicate poverty, meet human needs and ensure that all get a fair share of resources – very different from present development. Social justice today and in the future is a crucial component of the concept of sustainable development.

There were, and are, long standing debates about both goals and means within theories dealing with both environmental and socio-economic questions which have inevitably flowed into ideas on sustain-

able development. As Wackernagel and Rees (1996) have argued, the Brundtland Report attempted to bridge some of these debates by leaving a certain ambiguity, talking at the same time of the priorities of meeting the needs of the poor, protecting the environment and more rapid economic growth. The looseness of the concept and its theoretical underpinnings have enabled the use of the phrases 'sustainable development' and 'sustainability' to become *de rigueur* for politicians and business leaders, but as the Workshop on Urban Sustainability of the US National Science Foundation (2000, p. 1) pointed out, sustainability is 'laden with so many definitions that it risks plunging into meaninglessness, at best, and becoming a catchphrase for demagogy, at worst. [It] is used to justify and legitimate a myriad of policies and practices ranging from communal agrarian utopianism to large-scale capital-intensive market development'.

While many claim that sustainable development challenges the increased integration of the world in a capitalist economy dominated by multinationals (Middleton *et al.*, 1993; Christie and Warburton, 2001), Brundtland's ambiguity allows business and governments to be in favour of sustainability without any fundamental challenge to their present course, using Brundtland's support for rapid growth to justify the phrase 'sustainable growth'. Rees (1998) points out that this allows capitalism to continue to put forward economic growth as its 'morally bankrupt solution' to poverty. If the economy grows, eventually all will benefit (Dollar and Kraay, 2000): in modern parlance the trickle-down theory. Daly (1993) criticized the notion of 'sustainable growth' as 'thought-stopping' and oxymoronic in a world in which ecosystems are finite. At some point, economic growth with ever more use of resources and production of waste is unsustainable. Instead Daly argued for the term 'sustainable development' by which he, much more clearly than Brundtland, meant qualitative, rather than quantitative, improvements. Development is open to confusion, with some seeing it as an end in itself, so it has been suggested that greater clarity would be to speak of 'sustainable livelihoods', which is the aim that Brundtland outlined (Workshop on Urban Sustainability, 2000).

Another area of debate is between the views of weak and strong sustainability (Haughton and Hunter, 1994). Weak sustainability sees natural and manufactured capital as interchangeable with technology able to fill human produced gaps in the natural world (Daly and Cobb, 1989) such as a lack of resources or damage to the environment. Solow put the case most strongly, stating that by substituting other factors for natural resources 'the world can, in effect, get along without natural resources, so exhaustion is just an event, not a catastrophe' (1974, p. 11). Strong sustainability criticizes this, pointing out that human-made capital cannot replace a multitude of processes vital to human existence such as the ozone layer, photosynthesis or the water cycle (Rees, 1998; Roseland, 1998). Deep Greens would go further in arguing that non-human species, natural systems and biodiversity have rights and values in themselves (Naess, 1989). The debate between strong and weak sustainability is, however, conducted mainly around environmental issues rather than taking account of socio-economic consequences.

The concept of sustainable development represents a shift in understanding of humanity's place on the planet, but it is open to interpretation of being anything from almost meaningless to of extreme importance to humanity. Whatever view is taken, it is clearly an area of contention. Whilst recognizing the deep debates and ambiguities about the meaning of sustainable development, this paper uses the phrase 'sustainable development' to describe attempts to combine concerns with the environment and socio-economic issues.

Haughton (1999) has usefully summarized the ideas of sustainable development in five principles based on equity: futurity – inter-generational equity; social justice – intra-generational equity; trans-frontier responsibility – geographical equity; procedural equity – people treated openly and fairly; inter-species equity – importance of biodiversity. These principles help give clarity to the ideas of sustainable development, link human equity to the environment, challenge the more bland and meaningless interpretations and provide a useful basis for evaluation of the different trends of sustainable development.

Mapping Sustainable Development

The many different interpretations of sustainable development are confusing. To help make sense of them we are suggesting a mapping methodology based on combining environmental and socio-economic issues. O'Riordan (1989) in his widely used categorization of environmental views, from strong ecocentric to strong technocentric, pointed out that these often combine with socio-economic viewpoints so that ecocentrics tend towards social and economic equity and redistribution while technocentrics are more likely to support the economic and political status quo. However this is not always the case: as Marcuse points out, 'sustainability and social justice do not necessarily go hand in hand' (1998, p. 104), with sustainability masking injustice or on the other hand social justice masking environmental damage (Dobson, 2000). In many cases the linking of environmental and social concerns is based on a moral (Blowers, 1993) or sympathetic outlook rather than seeing the two as materially and socially related and inseparable. Others (Merchant, 1992; Dryzek, 1997) have also outlined useful ways of analysing environmental concerns; however, there has been less effort in mapping the many viewpoints on sustainable development.

To provide a generalized view of the trends within the sustainable development debate, O'Riordan's original mapping can be expanded by considering environmental and socio-economic views on two separate axes (Figure 1). The socio-economic axis covers the level of importance given to human well-being and equality and the environment axis covers the priority of the environment from low environmental concern through technocentred to ecocentred. The central shaded area of the map indicates the range

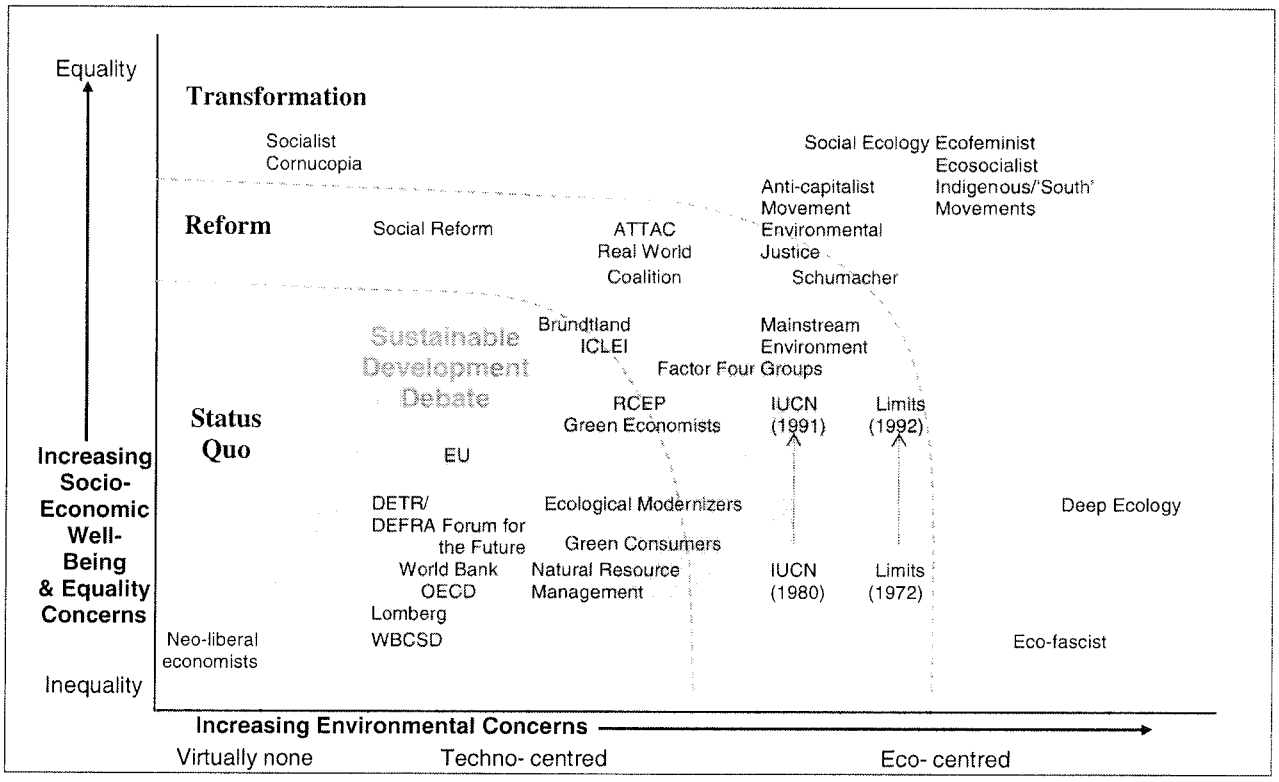

Figure 1. Mapping of views on sustainable development

of views within the sustainable development debate; combining socio-economic and environmental issues. There are views outside this area, concerned with either environmental or socio-economic issues while ignoring the other.

Overlaid on this map are three broad views on the nature of the changes necessary in society's political and economic structures and human–environment relationships to achieve sustainable development: that it can be achieved within the present structures – status quo; that fundamental reform is necessary but without a full rupture with the existing arrangements – reform; and that as the roots of the problems are the very economic and power structures of society a radical transformation is needed – transformation (Rees, 1995).

This is inevitably a broad conceptual framework rather than a precise mapping and exact locations are open to challenge. All classification into groups is a simplification and there can be debate about where the boundaries are drawn as well as how sharp or blurred they are. Individuals and groups change their views over time. There are also major debates within all these outlooks. To illustrate the mapping, some of the major trends within sustainable development are outlined.

Status Quo

Supporters of the status quo recognize the need for change but see neither the environment nor society as facing insuperable problems. Adjustments can be made without any fundamental changes to society, means of decision making or power relations. This is the dominant view of governments and business and supporters of the status quo are most likely to work within the corridors of power talking with decision makers in government and business. Development is identified with growth and economic growth is seen as part of the solution. The UK Department of the Environment, Transport and the Regions argues that 'to move towards more sustainable development, we need more growth not less' (DETR, 1999, para. 3.31). Supporters of the status quo are sympathetic to the changes in the role of government over recent decades with the reduction in the progressive nature of taxation, cuts in the social wage, privatization and reduction in regulation. They argue that business is the driver towards sustainability. Increased information, changing values, improved management techniques and new technology all operating through the market are the best means to achieve sustainable development.

Simon and Kahn see markets and technology as producing a future world that will be 'less polluted, more ecologically stable . . . and the world's people will be richer' (1984, p. 1). The World Business Council for Sustainable Development (1998) sees no conflict between the growth of the global market and environmental stability: 'we can have an open vigorous and healthy trading system and achieve sustainable development'. The OECD (2001) urges fiscal changes to taxation and subsidies and increased private ownership of resources to make markets work for sustainable development as well as confidence that globalization does not weaken social and environmental protection. Lomborg (2001), in the tradition of Pangloss, challenges most of the claims of those concerned about the environment, poverty and hunger. He states that to improve the 'environmental quality of the developing world, securing growth so as to lift these people out of hunger and poverty is of the utmost importance since . . . only when we are sufficiently rich can we start to . . . deal with environmental problems'.

Most Ecological Modernizers (Beck, 1992; Mol and Sonnenfeld, 2000) support the status quo, although some see the need for reform. They support the market, 'the key to ecological modernization is that there is money in it for business' (Dryzek, 1997, p. 142), and technology in a partnership of government, business, moderate environmentalists and scientists with much less concern for equity, justice or human well-being (Alier, 2003). Jacobs (1999) argues that the environment and sustainable development are not central to New Labour but that environmental modernization (or ecological modernization as called in Europe) would be an environmental approach in sympathy with New Labour's outlook.

Supporting the reduced role of government, supporters of the status quo are reluctant to use laws and regulations. Instead, consumer power, informed about sustainability issues and based on lifestyle choices, will combine with 'green' capitalists who practice 'corporate citizenship' and ethical business to achieve sustainable development (Elkington and Burke, 1987). There is little discussion on governance other than references that in some countries the rule of law (usually meaning defence of property rights) should be strengthened and outright bribery diminished. The need to increase wider democratic rights, especially on economic decisions, is hardly mentioned. It is assumed that the existing governmental and commercial systems can be nudged towards improvements with use of management techniques such as EIA (environmental impact assessment), EMAS (eco-management and audit system), cost/benefit analysis, BATNEEC (best available techniques not entailing excessive cost) and BPEO (best practicable environmental option). In parallel, technical economic tools such as modest environmental taxes, pollution trading permits and ethical shares will encourage the move to sustainable development.

Any classification has its difficulties and Garrett Hardin well illustrates some of these. In his 'Tragedy of the commons' (1968) he advocates widespread private ownership of resources to protect the environment, which puts him in the status quo group in economic terms. On the other hand his 'lifeboat ethic' (1974), which argues that the poor should be left to starve, and his support for 'coercion' (1968) put his social views towards eco-fascism.

Most supporters of the status quo have a weak commitment to environmental sustainability, although for some such as Solow (1974) it is barely needed at all, as technology can replace nature. There is a similar weak concern with poverty and the lack of equity in political power. Generally the status quo argument is that growth is the way to overcome these problems. The World Bank (2000, p. vi) states that the 'traditional elements of the strategy to foster growth – macroeconomic stability and market-friendly reforms – are essential for reducing poverty'.

Reform

Those who take a reform approach accept that there are mounting problems, being critical of current policies of most businesses and governments and trends within society, but do not consider that a collapse in ecological or social systems is likely or that fundamental change is necessary. They generally do not locate the root of the problem in the nature of present society, but in imbalances and a lack of knowledge and information, and they remain confident that things can and will change to address these challenges. They generally accept that large shifts in policy and lifestyle, many very profound, will be needed at some point. However it is assumed that these can be achieved over time within the present social and economic structures. The key is to persuade governments and international organizations, mainly by reasoned argument, to introduce the needed major reforms. They focus on technology, good science and information, modifications to the market and reform of government. This group covers a range of people, some in government and public agencies, but it is largely dominated by academics and mainstream NGO experts. Interestingly, some governmental bodies such as the Royal Commission on Environmental Pollution (RCEP), and some areas of local government, such as the International Council for Local Environment Initiatives (ICLEI), have a more radical view than the UK government.

A common theme is the benefits that technology can bring to protecting the environment. Weizsacker *et al.* (1997) for example call for a large reduction in the use of materials in the economy, by at least a factor of four. There is widespread support for a dramatic increase in energy efficiency and change in energy use from fossil fuels to renewable sources (Flavin and Lenssen, 1994). It is argued that these changes will offer market opportunities for businesses and they should grasp the changes, both for the

environment and profits (Hawken *et al.*, 1999). In general it is claimed that the new technologies will provide wider economic and social benefits for humanity as well as protecting the environment.

Green economists argue that the market needs modification to redress market failure and regulation to achieve ecological sustainability. Pearce *et al.* (1989) urge the internalization of hitherto externalized environmental costs and a recalculation of environmental benefits. Hawken *et al.* (1999) and Roodman (1996, 1997) argue for government action to change the balance of tax and subsidies to favour employment and environment rather than energy consumption and to encourage business to change production technology. Daly and Cobb (1989) look to a combination of strong sustainability with market modification to include social and environmental costs. Korten (1996) believes that the global corporations and the international agencies such as the World Bank and IMF need to be controlled so that capitalism is able to protect the environment and raise living standards for all.

Reformers recognize that government has a key role in moving towards sustainable development as business will need pushing, and in some cases controlling, taxes and subsidies changing, targeting of research and disseminating of information. Most reformers also assume that there will be reform of the political system to increase democracy and participation. Girardet (1999), a leading figure in urban sustainability, puts the emphasis on the city level, arguing that a combination of best practice, enlightened civic leaders, active partnership with local business and public determination are the best way to success. The Real World Coalition (Christie and Warburton, 2001), which represents 25 UK campaigning NGOs, links environmental and socio-economic concern. It points out that the present 'business as usual' 'is itself a source of our greatest dangers' (p. 184) due to mounting inequality and poverty, environmental degradation and world instability. They believe 'radical reform' (p. viii) is needed to produce a 'democratic revitalization' (p. 184) so that government and society produce 'sustainable, accountable and equitable forms of capitalism' (p. 184).

The growing environmental concerns of the 1960s and 1970s had by the 1980s became part of the mainstream debates on development and economics. The *Limits to Growth* report (Meadows *et al.*, 1972) and the *World Conservation Strategy* (IUCN *et al.*, 1980) both helped to push environmental issues up the world's political agenda. Interestingly, the sustainable development debates encouraged the authors to embrace more socio-economic issues.

The *Limits to Growth* report (Meadows *et al.*, 1972) challenged head on the idea that growth, as defined by capitalist economics, was the way to improve environmental quality; in fact they argued it was damaging the environment. The Brundtland report rejected the idea that there were environmental limits to growth (Kirkby *et al.*, 1995). When the authors of *Limits to Growth* revisited the issue in 1992 (Meadows *et al.*), while they maintained that there are limits to growth, they opened a bridge towards the ideas of Brundtland, although they talk about a 'sustainable society'. They also refer to social issues including tackling poverty.

The World Conservation Strategy (IUCN *et al.*, 1980) was one of the first to use the term sustainable development. The 1980 report, concerned with human needs, concentrated entirely on environmental changes without discussing changes in socio-economic structures or distribution. The 1991 report, (IUCN *et al.*, 1991) although still concentrating on environmental issues, shows a greater recognition of social issues proposing changes in socio-economic structures, increasing participation in decisions, improving the quality of human life and modifications to the world economy.

The mainstream environmental groups such as Friends of the Earth, Greenpeace, WWF and Sierra Club are largely in the reform group and increasingly have moved from grass roots activism and mass protest to political lobbying and working with business and government (Bullard, 1994; Rowell, 1996). They have given less focus to linking with social issues of poverty or even the disproportionate share of pollution and other environmental issues suffered by the poor within the developed world (Bullard, 1994; McLaren *et al.*, 1999).

Some of the reformers edge towards the transformation group, such as Schumacher (1973), who argues that the economy should be run 'as if people mattered', with the implication that small and local is more sustainable than large and global, although he envisages small as being privately owned and operating in a market economy. Other reformers lean much more towards the status quo. The Brundtland report is generally reformist in broad tone but leans towards the status quo in proposed details.

Transformation

Transformationists see mounting problems in the environment and/or society as rooted in fundamental features of society today and how humans interrelate and relate with the environment. They argue that a transformation of society and/or human relations with the environment is necessary to avoid a mounting crisis and even a possible future collapse. Reform is not enough as many of the problems are viewed as being located within the very economic and power structures of society because they are not primarily concerned with human well-being or environmental sustainability. While some may use the established political structures and scientific arguments they generally see a need for social and political action that involves those outside the centres of power such as indigenous groups, the poor and working class, and women. The transformationists include those who focus either primarily on the environment or the socio-economic, and those who synthesize both.

Transformation without Sustainable Development

As sustainable development is a human-centred view of the inter-relations between environmental and socio-economic issues, some transformationists are not concerned with sustainable development.

Deep ecologists' primary concern is the environment, with the emphasis on the intrinsic value and needs of nature and the environment, while human needs come very much second. In the eight points of the deep ecology platform (Naess, 1989) there is little on human needs and nothing on equity. Bradford (1989), in a critique of deep ecology, points to the trend towards racism and support for imperialism as well as an anti-human outlook behind their 'nature first' rhetoric. David Foreman, one of the founders of Earth First!, was notorious for saying of the famine in Ethiopia that 'the best thing would be to just let nature seek its own balance, to let the people there just starve' (quoted by Bradford, 1989, p. 33). As Bramwell (1989) argues, there is an association between some green and fascist thinking. Of course not all deep ecologists have such a low concern for humanity. Although Lovelock (1988) sees the earth's ecosystem as self-sustaining Gaia, he urges humanity to act in its own interest. Gaia will survive human actions but humans may not survive the damages we inflict or Gaia's need to save itself. Other deep ecologists, such as Earth First! in Scotland (Cock and Hopwood, 1996) and Eckersley (1992), combine ecocentrism with a commitment to socio-economic equity. For some this is expressed as a desire to return to the 'simple life' (Devall, 1990) or a subsistence perspective (Bennoldt-Thomsen and Mies, 1999).

In contrast to deep ecologists, socialist cornucopians prioritize the need for social transformation to overcome social and economic inequality. Some hardly address environmental issues, believing that human skills, freed from capitalism, can overcome all problems (Zazubrin in Cock and Hopwood, 1996). Others, while acknowledging environmental concerns, believe they can be laid firmly at the feet of capitalism and will be solved by social ownership of the means of production (Grundmann, 1991).

Transformation and Sustainable Development

Those who adopt a transformatory approach that embraces both social and environmental questions cover a range of different viewpoints although all share the view that the mounting crises in the envi-

ronment and society are interconnected and that the social and environmental systems risk breakdown if radical change does not occur (George, 1999; Rees, 1995). Some, such as grass roots environmental justice and indigenous environmental movements, may not use the same vocabulary of sustainable development as used in official and academic circles but are addressing the issues of how to live within the environment without great inequality or poverty. Transformationists see the fundamental problems as rooted in our present society, which is based on the exploitation of most people and the environment by a small minority of people.

A transformation view of sustainable development has a strong commitment to social equity, with a view that access to livelihood, good health, resources and economic and political decision making are connected. In the absence of people having control over their lives and resources, inequality and environmental degradation are inevitable. The Soviet Union, in its statist and undemocratic version of public ownership, damaged the environment and had entrenched inequality because people lacked real power (Sarkar, 1999). Similarly, the large global corporations and many governments are not under public control. Organizations of popular action and control (radical political parties, community groups, environmental campaigns, trade unions, etc) are the main restraints on unsustainable actions. Transformationists argue that these currently limited restraints need to be extended to real control (Pepper, 1993; Dryzek, 1997).

Social Ecology or Dialectical Naturalism is a perspective associated with the ecoanarchist Murray Bookchin. In his view humanity and nature are in a dialectical relationship and environmental concern needs to be 'rooted in social criticism and a vision of social reconstruction' (1989, p. 13). His main concern is the power of the state and he puts forward government through local municipalities based on direct democracy through local assemblies.

Ecofeminists see a relationship between the degradation of the environment and the subordination of women (Buckingham-Hatfield, 2000; Mellor, 1997a). There is a range of approaches from cultural/biological associations of women with nature (Collard, 1988) to more social analysis (Salleh, 1997). Mies and Shiva (1993) combine the two approaches, arguing that women have a special affinity with nature, which capitalist 'maldevelopment' is destroying as well as undermining many sustainable social structures and increasing poverty. Mellor has developed a version of ecofeminism that is linked closely with ecosocialist analysis, which argues that capitalism attempts to detach production and social life from nature through gender and class divisions (1992, 1997b).

Much of ecosocialist thinking draws on the writing of Marx and Engels on the nature of human society and its relation with the environment: 'We by no means rule over nature like a conqueror over a foreign people, like someone standing outside nature – but . . . we, with flesh, blood and brain, belong to nature, and exist in its midst' (Engels, 1968). These link inequality and environmental damage to capitalism's exploitation of people and the environment (Cock and Hopwood, 1996). Ecosocialists argue for the need to change material conditions and the social structure of society to overcome both environmental crises and injustice (Pepper, 1993). This leads them to see a common linkage between many struggles for justice and environmental protection. James O'Connor launched the journal *Capitalism, Nature, Socialism* in 1988 with the analysis of a 'second contradiction' for capitalism that links environmental and social crisis in a material and class analysis (O'Connor, 1988).

As well as these transformational ideas there are also a range of campaigns and actions that seek to transform society. Many of the campaigns in the 'South' around sustainable development, in all their variety, closely link environmental, social, economic and anti-globalization struggles. These are some of the most energetic challenges to status quo and reformist approaches to sustainable development. Leff (2000) argues that indigenous environmental movements are not only challenging the failure of environmental and social justice within global development processes, but also offer a clear alternative environmental rationality. Their grassroots struggles covering 'social equity, cultural diversity and

environmental democracy define new political values and a new social rationality for sustainability' (p. 70) which develops 'sustainable productive projects and give meaning to their lives' (p. 69). The struggle of the Brazilian rubber tappers, formerly led by Chico Mendes, started on trade union rights (Hecht and Cockburn, 1990). The campaign of the Ogoni people of Nigeria, led by the murdered Ken Saro-Wiwa, began on social justice (Rowell, 1996). The Chipko movement in India, mainly of women, began by protecting trees (Guha, 1989). The Zapatista uprising in Chiapas began on issues of land reform (Weinberg, 2000). All these struggles and many others had their roots in local circumstances of oppression and have spread both to embrace wider environmental, social and economic justice issues and internationally.

In the developed world as well, there are growing struggles for environmental justice, which unite social and environmental issues. Although too often ignored by mainstream environmental groups, these actions, especially of the poor, racial minorities and those without political power, all point to a more sustainable society. Hofrichter (1993, pp. 4–5) states that 'Environmental justice is about social transformation directed toward meeting human need and enhancing the quality of life – economic equality, health care, shelter, human rights, species preservation and democracy – using resources sustainably' and that achieving it 'demands major restructuring of the entire social order'. Gibbs (1993, p. x), a leader of the battle of Love Canal, explains that battles for environmental justice usually starts with a local single issue but people 'realize the root of their problem is the lack of organized political power, deteriorating neighborhood conditions, poverty and race . . . recognize the international dimensions of the problem . . . build an even broader coalition for change . . . with civil-rights and labor organizations, housing groups, women's groups and healthcare advocates . . . these new alliances and cooperative work can achieve real democracy'.

The worldwide growth of the anti-globalization and anti-capitalism protests that have greeted meetings of the world's powerful politicians and businesses leaders links struggles across the world and addresses many of the issues of sustainable development. The ideas in this movement range from reform of the world financial system, such as the ideas put forward by ATTAC, to outright opposition to capitalism.

Within the broad range of transformative perspectives on sustainable development there is a constant interchange of ideas and cross-fertilization, which sometimes makes classification difficult, but enriches both ideas and practice.

Conclusion: Towards Sustainable Development

All proponents of sustainable development agree that society needs to change, though there are major debates as to the nature of sustainable development, the changes necessary and the tools and actors for these changes. There is no such thing as a single unified philosophy of sustainable development; there is no sustainable development 'ism'. In most cases people bring to the debates on sustainable development already existing political and philosophical outlooks.

Further confusion about sustainable development arises as people use the same words to mean a wide divergence of views on the goals, routes and the methods of moving towards sustainable development. This is further complicated because, as in many political issues, some people may say one thing and mean another. On some occasions reformers and transformationists will tone down their arguments to persuade a government or business to move along the sustainable pathway. On the other hand some may use more radical rhetoric than they actually believe or practice to deflect criticisms.

There is a fundamental divide between the supporters of the status quo and a transformation in their concept of and approach to sustainable development. The status quo approach sees change through

management, top down and incremental, of the existing structures of decision-making. The transformation view is that change will be mainly through political action working both in and outside the existing structures. The sustainable development discourse at present is dominated by the managerial outlook.

In most of the world the issues of sustainable development are not at the top of the world's policy agenda; even issues such as climate change or mass starvation do not dominate the news or political debate. However, the challenges at the core of sustainable development, the environment and equity, will force it up the political agenda.

The usual model for sustainable development is of three separate but connected rings of environment, society and economy, with the implication that each sector is, at least in part, independent of the others. Defenders of the status quo see the root cause of a lack of sustainable development in the lack of knowledge and appropriate mechanisms, rather than a fundamental linkage. This view allows for trade-offs between environmental and social issues, whether it is that some pollution is acceptable to increase growth, or loss of some pastureland for a park, or jobs for cleaner air. These trade-offs indicate a continued conceptual divide between the environment and humanity. The reality is that humanity is dependent on the environment, with society existing within, and dependent on, the environment, and the economy exists within society. Humans live within the environment (Giddings *et al.*, 2002) and depend on it for survival and well-being; we cannot ignore the environment.

There is growing evidence of human caused climate change, both scientific study (Sample, 2003) and more anecdotal such as the fires across the northern hemisphere in the summer of 2003. The loss of biodiversity and the salinization of soil continue, largely due to the present production and marketing methods.

If the status quo vision of world development were true and at some future date the poor of the world had the same living standards as those of the USA or Europe, could the world cope? The USA with 290 million people has over 210 million motor vehicles, while the world today has 6000 million people and 520 million vehicles. If the entire world were at same level as the USA there would be 4400 million vehicles. Is there enough petroleum to run them or could the world's atmosphere cope with the carbon dioxide and pollution releases?

Even in the area of economic growth, to which supporters of the status quo give priority, the trend is away from sustainable development (Middleton *et al.*, 1993), there is no sign of an increase in global equity; in fact the world is becoming more unequal. The USA, compared with its share of the world's population, continues to greatly over-consume resources and release pollution. In the last 50 years world trade has grown 17-fold, but the share of the poorest nations has collapsed. The gap between the richest 20% and the poorest 20% has widened substantially; from a factor of 30 in the 1960s to 86 in 1997, with the three richest people having more assets than 600 million people (UNDP, 1999). Even within the richest countries, inequality has increased (Jacobs, 1996; Christie and Warburton, 2001). Far from the promised trickle-down, wealth, unlike water, is rushing uphill. Malaria, a disease that is linked to poverty both in the likelihood of being infected and in its impacts, kills 5000 African children a day, yet could be controlled with modest expenditure (Rabinovich, 2002). The UN states that two problems, poverty and child mortality, are 'intractable' (UNDP, 2002).

How will society deal with the growth in inequality and mounting environmental problems? Can we continue as we are? At present the status quo view dominates policy, but their policies are an inadequate answer to the needs of sustainable development; it is argued that they have used the phrases of sustainable development to continue with and justify business as usual (Kothari, 1990). Embracing the status quo is not a viable option for society if we are to move towards sustainable livelihood for all, now and in the future, within an abundant and diverse environment. The future is likely to be dominated by choices between more radical views.

One option is that advocated by Hardin (1974), that the rich and powerful of the world have a lifeboat ethic of extreme gated communities to ensure their own privileged survival. The outcome would be increased inequality, environmental degradation and probably wars. This trend is reflected in the thinking of the US government, which has turned concerns about security in dealing with environmental risks, mostly due to human actions (Beck, 1992), into a programme of security based on military action to protect unsustainable policies such as the USA's oil consumption (White House, 2000; Dalby, 2003).

The alternative suggested by the Deep Greens would share out the reduction in living standards more fairly in a world that drastically reduces consumption and, they usually suggest, population. However, who will decide which of the world's billion shall die? A return to low technology and living on the land would risk a return to the poverty and high infant mortality of the past for the west and continuation of the nightmarish present for many of the poor of the world. This too might well be a recipe for social conflict and wars. It certainly would not be a future based on the ideas of sustainable development.

Reformers would reject the grim views of Hardin or deep greens while acknowledging that 15 years after Brundtland many trends are still getting worse. The challenge for them is how and why governments and big business will self-reform to challenge the powerful vested interests that act in ways contrary to sustainable development.

The future envisaged by transformationists takes a different view, starting from the view that environmental degradation, poverty and a lack of justice are not a historical coincidence. The linkage is not simply moral; it is rooted in a society of domination and exploitation of the environment and most people. In what O'Connor (1989) describes as combined and uneven development, some communities and people are rich because others are poor and vice versa. O'Riordan states that 'wealth creation based on renewability and replenishment rather than exploitation . . . is a contradiction in terms for modern capitalism', so that real sustainable development requires a 'massive redistribution of wealth and power' (1989, p. 93). Transformationists emphasize justice and equity, believing that if these are not central to any analysis the ecological problems will be blamed upon a common 'us', who are held equally to blame. This trend is evident in some deep ecologists' thinking that holds all humanity responsible for the ecological crisis, thus masking divisions of race, class and gender. In an unequal society it is those who are least powerful who suffer poverty and lack of access to resources. The poor also have to bear the heaviest burden of ill-health, war and ecological problems (Sachs, 1999; UNDP, 2002; Agyeman *et al.*, 2003).

Transformationists' view of the connection between environmental degradation and human exploitation encourages the building of alliances between environmental and social justice movements. The challenge they face is how to mobilize a coalition that is powerful and cohesive enough to realize the needed changes. The core values of sustainable development as outlined by Haughton are environment protection and justice. The issues that transformationists are facing, of how to combine these two, will increasingly become main stage as society faces the challenges of the future.

Although open to many interpretations, sustainable development has gained wide currency. It crucially embraces the key issues for humanity of how to ensure lives worth living and our relation with the planet and our relations with each other.

Rather than discarding the concept of sustainable development, it provides a useful framework in which to debate the choices for humanity. We have argued that sustainable development needs to be based on appreciation of the close links between the environment and society with feedback loops both ways, and that social and environmental equity are fundamental ideas.

Given the need for fundamental change, a deep connection between human life and the environment and a common linkage of power structures that exploit both people and planet, we would argue that transformation is essential. However, we do not see it as necessary or sensible to make an exclusive commitment to transformation. Reform now is better than nothing and transformation may not be immediately feasible. However, whilst engaging with government and business for reforms, the main

focus should be to raise the issues, successful mobilization of the media and to build coalitions linking researchers, popular protest and direct action.

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Biography

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Appendix 3

Climate Change and Disaster Management.
Disasters
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O'Brien, G. O'Keefe, P. Rose, J. Wisner, B. (2006)

Climate change and disaster management

Geoff O'Brien, Phil O'Keefe, Joanne Rose and **Ben Wisner**[1]

Climate change, although a natural phenomenon, is accelerated by human activities. Disaster policy response to climate change is dependent on a number of factors, such as readiness to accept the reality of climate change, institutions and capacity, as well as willingness to embed climate change risk assessment and management in development strategies. These conditions do not yet exist universally. A focus that neglects to enhance capacity-building and resilience as a prerequisite for managing climate change risks will, in all likelihood, do little to reduce vulnerability to those risks. Reducing vulnerability is a key aspect of reducing climate change risk. To do so requires a new approach to climate change risk and a change in institutional structures and relationships. A focus on development that neglects to enhance governance and resilience as a prerequisite for managing climate change risks will, in all likelihood, do little to reduce vulnerability to those risks.

Keywords: adaptation, climate change, disaster reduction, international cooperation, Millennium Development Goals, poverty, resilience, risk, sustainable development, vulnerability

Introduction

Disasters triggered by natural hazards are killing more people over time and costing more. This is the trend revealed by data collected by the Center for Research on the Epidemiology of Disaster (CRED) in Belgium (EM-DAT, 2005) and by the world-wide re-insurance industry. The world's poorer nations are disproportionately affected (Munich Re Group, 2002; IFRC, 2003), and the most vulnerable and marginalised people in these nations bear the brunt. The data show that economic losses have risen sevenfold since the 1960s, with reported losses of USD 659.9 billion in the 1990s. Two-thirds of these economic losses were reported were accrued by more developed countries (MDCs). However, deaths are concentrated in less developed countries (LDCs). The International Federation of Red Cross and Red Crescent Societies (IFRC) reports that between 1992 and 2001, 27,464 and 594,899 fatalities occurred in MDCs and LDCs respectively (IFRC, 2002). The ratios are striking: between 1991 and 2001, in countries with low human development indexes (HDI), there were 1,052 deaths per disaster and only 23 deaths in countries with a high HDI. Although MDCs suffer substantial economic ramifications, this masks the real impacts on poorer nations. In the case of MDCs, the data are a reflection of the value of infrastructure and assets at risk, not of development potential. For states with a very low gross national income (GNI), even a small economic loss is critical. Economic losses in developing countries can be very significant in slowing human development.

There may be issues surrounding the validity of the data (Quarantelli, 2001), but the trend is unmistakable. The increase in the occurrence of disasters is impacting

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disproportionately on the poor (Wisner et al., 2004). This is a challenge for the international community. If the Millennium Development Goals (MDGs) are to be realised in a sustainable fashion then reducing the impact of disasters is an urgent priority (Middleton and O'Keefe, 2001; DFID, 2004a; UNDP, 2004a; Wisner and Walker, 2005).

The data mentioned above refer to losses stemming from natural disasters of all types; however, there is mounting concern about the impacts of disasters related to climate change. Climate change brings with it long-term shifts in mean weather conditions and the possibility of increasing frequency and severity of extreme weather events. The Intergovernmental Panel on Climate Change (IPCC) notes:

> *Populations are highly variable in their endowments and the developing countries, particularly the least developed countries . . . have lesser capacity to adapt and are more vulnerable to climate change damages, just as they are more vulnerable to other stresses. This condition is most extreme among the poorest people* (IPCC, 2001, section 2.8).

Most disasters, or more correctly, hazards that lead to disasters, cannot be prevented. But their effects can be mitigated. What is clear is that disasters are conditioned by human activities. Hazards may be natural in origin, but it is the way in which societies have developed that causes them to become disasters (Maskrey, 1993; Hewitt, 1996; Bhatt, 2002; Wisner et al., 2004).

Planning to reduce the impact of disasters is not new. The international community has made substantial effort to reduce the impact on people and livelihoods of disasters with both natural and technological triggers. Many techniques to prepare for, to reduce potential losses from, and to respond and adapt to, hazards have been developed (UN/ISDR, 2004). Disasters can erase the benefits of development investments, and poorly planned development interventions may become a source of hazard. Therefore, disaster planning is a necessary step and is needed to realise the MDGs and sustainable development. These are elements of a consensus that was reaffirmed at the World Conference on Disaster Reduction (WCDR) in Kobe, Japan, on 18–22 January 2005. Also at that meeting climate change was recognised as posing an immediate and long-term threat to the achievement of the MDGs and sustainable human development, and, as such, should be an integral part of disaster planning (UN/ISDR, 2005).

Since climate change is a source of multiple hazards that threaten long-term development actions by the international community, the consensus and planning approaches that have linked development and disaster should extend to climate change. This paper shows that this extension has not yet taken place and argues that it is urgent that it does occur.

Approaches to disaster management

The focus of disaster management is to reduce the risk posed by actual and potential hazards (Alexander, 2002b). Hazards can be broadly grouped into three areas: natural; technological; and complex emergencies. Although this is a broad categorisation of

hazard, it should be recognised that new forms of hazard are constantly emerging, including terrorist movements, novel technologies and genetically modified organisms. Hence, disaster management needs to change and evolve to cope with these new and emerging threats (Kent, 1999; Feinstein International Famine Center, 2004; O'Brien and Read, 2005). Climate change, while not a new phenomenon, is also included in the category of emerging threats and has been described by UK Chief Scientist Sir David King as a greater threat than terrorism (King, 2004). Two different response regimes have evolved to address the problems associated with the different categories of hazard often with little cross-fertilisation or sharing of knowledge between them. One utilises risk assessment as a starting point, while the other begins with a needs assessment.

Natural and technological hazard

The principal focus of planning for natural and technological hazards is risk assessment and reduction. Efforts to prevent and plan for natural and technological disasters have arisen from the need to protect society from hazards that are prevalent in the area of governmental jurisdiction. This approach to risk reduction and civil protection has been developed through legislation, the defining of institutional responsibilities and the allocation of financial resources (top down), coupled with local responses and community involvement (O'Brien and Read, 2005; Alexander, 2002a). Such a comprehensive approach to multi-hazard planning is a feature of the strategy of Organisation for Economic Co-operation and Development (OECD) countries and has evolved from extensive research into both natural and anthropogenic disasters (Lindell and Perry, 2003; Alexander, 2002b; McEntire et al., 2002; Mileti, 1999; Tobin, 1999). Disaster planning is based on risk assessment and lessons learned, which are codified into a set of risk management and emergency plans designed to enable effective and efficient policies and practices. This approach to risk management can be effective in areas prone to natural hazards, such as flood plains, storm corridors and seismically active zones. In Australia, Japan, the US and other MDCs, preparedness and mitigation strategies, combined with high coping capacity (a function of income, savings and insurance), ensure that, although events may cause extensive damage, mortality rates are usually low and communities are able to recover quickly.[2] Examples include the recovery of Florida, US, from numerous recent hurricanes (Tobin, 1999), the decade-long recovery of Kobe, Japan, from the 1995 Great Hanshin-Awaji earthquake (Toshihisa et al., 1999) and the recovery of Darwin, Australia, from the destruction of 70% of its building stock by Cyclone Tracy in 1974 (Blong, 2004). The ultimate aim of planning is disaster risk reduction, with the final outcome being a decrease in losses and a speedy return to normality. To work effectively, this holistic approach to planning requires accountable, democratic government institutions, financial support, political will and the trust of civil society.

In LDCs, such an approach to risk and disaster management also exists, at least on paper. It involves commissions and institutions at the national, sub-national, regional and municipal level, which have proliferated since the beginning of the International Decade for Natural Disaster Reduction (IDNDR) (1990–99). There had been

another flurry of similar institution building during the 'environment decade' of the 1970s, during which institutions were developed to monitor and protect the human environment from pollution. Implementation, however, lags behind institutionalisation and planning in many of these countries.

One must also juxtapose 'top down' disaster management in both MDCs and LDCs with the self-protection efforts made by households and communities themselves—actions based on local knowledge and the activities of the institutions of civil society that work on natural and technological hazards from 'the bottom up' (Cannon, 2000; Wisner et al., 2004; UN/SDR, 2004; Wisner and Walker, 2005).

Humanitarian and complex emergencies

In complex and rapidly changing environments, often triggered by violent conflict, government agencies responsible for social protection may not be able to gain access to civilian populations. International refugees may well require support in remote and inaccessible border areas. Internally displaced persons (IDPs) often place heavy demands on local governments and the host population. The response to these cases by the international community—United Nations (UN) agencies, international organisations like the IFRC and international non-governmental organisations (NGOs)—is to complement government efforts to bring relief to those affected.

In such complex emergencies, planning takes the form of a needs assessment and the delivery of goods and services to meet requirements. Human demand for water, food, shelter, sanitation, healthcare, security and, somewhat later, for children's education, perhaps job training and counselling, is balanced against available resources (Wisner and Adams, 2003; UNICEF, 2005). Appeals for aid are formulated. Resources are allocated and results are tallied up in periodic evaluations. Meanwhile, in parallel, in an ideal situation, peacemaking and conflict resolution are occurring, so that eventually repatriation and resettlement become possible.

Humanitarian interventions typically deal with immediate relief, whereas longer-term recovery and development are the remit of other agencies (although some humanitarian entities are involved in both spheres). Increasingly, the humanitarian sector is driven by the need to show results. In complex and chaotic environments, with multiple agency involvement (and possibly intense international media attention), responsibility for success or failure can be very difficult to determine (Hofmann et al., 2004). There is a danger that this focus on results can exacerbate the problem of linking relief and development efforts. The humanitarian and development sectors have different agendas and operating modes, yet they have a shared interest in human well-being. The humanitarian sector often can be typified as neutral and 'state-avoiding', whereas the development sector relies on the state as a partner (Harmer and McRae, 2004). The activities of the humanitarian sector are guided by recognised standards, such as the Humanitarian Charter and Minimum Standards in Disaster Response (Sphere Project, 2005). This externally guided approach, although focused on needs and rights, does raise concerns about appropriateness, as the humanitarian system is 'largely ignorant of the views of the affected people as to the assistance being provided' (Hofmann et

al., 2004, p. 32). By contrast, the principal vehicle for the development sector is the Poverty Reduction Strategy Papers (PRSPs) whose mandate is to ensure stakeholder participation, though there are doubts regarding the value and depth of participation (Stewart and Wang, 2003).

Despite difficulties in bridging the divide between relief and development, it is crucial to attempt the span to close the gap. Better cooperation between practitioners and researchers in these fields is not impossible, yet there is a need for more effective communication between the sectors, particularly in protracted crises. With the prospect of increasing frequency of climate change-related disasters, both rapid onset, such as floods, or slow onset, such as drought and famine, maintaining and increasing communication will be a challenge, since agencies will be increasingly over-stretched and hence will possibly revert to type. If so, future events will continue to dwarf the number of those that have become, as UN Secretary-General Kofi Annan put it in a 2005 interview, hidden or forgotten (BBC, 2005).

Climate change

Climate change can be described as both a complex and protracted hazard and as such does not sit comfortably in either of the current response regimes outlined earlier. It is a natural phenomenon but one that is caused by anthropogenic emissions of greenhouse gases. Climate change is a multifaceted (from drought to flood) and multidimensional (from local to global) hazard that has short-, medium- and long-term aspects and unknown outcomes.

What we do know is that climate change is intensifying the hazards that affect human livelihoods, settlements and infrastructure. It is also weakening the resilience of livelihood systems in the face of increasing uncertainty and frequent disasters (Masika, 2002). The disease ecology and geography of some human, livestock and plant diseases are changing. Population movements in response to climate change may also result in new exposure to hazards. Climate-displaced persons may suffer complex emergencies and strife as they flee with disregard for clan, tribal and national boundaries. Furthermore, climate change can increase vulnerability to unrelated, non-climatic hazards. An urban earthquake, for example, hitting when the elderly population is already suffering from the kind of heatwave that claimed 35,000 lives in Europe during 2003, would be much more stressful for such vulnerable groups (Earth Policy institute, 2003). Alternatively, an earthquake during a drought may come at a time when reservoirs and water pressure are too low to combat fires adequately (Scawthorn, 2000). One recent study presented a scenario in which an earthquake destroyed dikes separating salt and fresh water in the Sacramento River delta in northern California, which is a major source of water for Los Angeles. Such an earthquake scenario would create technological drought, a situation that would be all the harder to deal with in a warmer climate (Reisner, 2003).

The UK Department for International Development (DFID) argues that climate change increases the urgency to integrate risk management into development interventions and points out that the impacts of climate change-related disasters are multifaceted.

Not only can they lead to loss of life and the destruction of homes, infrastructure and livelihoods, but they can also cause significant financial damage, which can impede or compromise development. The losses caused by Hurricane Mitch to Honduras and Nicaragua in 1998 totalled more than the combined gross domestic product (GDP) of both countries, setting development back 20 years (DFID, 2004b).

The risks associated with future climate change will be determined by the interaction of hazards and vulnerability—as will other types of risk. LDCs are more vulnerable to climate-related disasters and those countries unable to cope with current climate-related disasters will be the most poorly equipped to deal with the adverse impacts of climate change (Adger and Brooks, 2003). Of equal concern are the highly skewed costs of adaptation to climate change at global and local scales. The long-term and uncertain nature of climate change impacts means the susceptibility of societies and the costs of adaptation draw attention to some pertinent debates about social and inter-generational equity (Adger et al., 2001). MDCs produce the majority of greenhouse gases but the ramifications will be felt most by the poorest nations. The impacts will be severe, yet LDCs lack adaptive capacity.

A holistic approach?

The final outcome documents of the WCDR have provided a 'green light' for a comprehensive approach to risk management, which would integrate natural hazards mitigation, 'routine' development efforts, such as investment in initiatives aimed at realising the MDGs, and efforts to address climate change. The question is, however, what approach to planning is compatible with all three and provides a bridge among natural hazards mitigation, sustainable human development and adaptation to climate change? The answer is that climate change adaptation needs to become part and parcel of comprehensive risk management, as argued above. The irony is that planning for climate change impacts to date, resembles far more the 'needs assessment and delivery' approach that has evolved in the planning toolbox of humanitarian assistance in conflict and post-conflict situations. The reasons for this are not completely clear, but one lies with the bureaucratic division of labour within the UN system and within between bilateral donor organisations and their scientific advisors (Walker and Wisner, 2005). Another reason may have to do with the relative lack of attention paid to drought and other 'creeping disasters' by the international disaster management community (Vlek, 2005). Drought was not even included in the mandate of the International Decade for Natural Disaster Reduction (1990–99) until it was half way over.

The underlying drive of disaster management is to reduce risk both to human life and to systems important to livelihoods. Risk to human populations is a function of the frequency of a hazard event, its severity and people's vulnerability (Wisner et al., 2004). Vulnerability depends on many factors that influence the amount of damage and the loss of human life that a particular hazard can cause. These variables include exposure, physical susceptibility, socio-economic fragility and lack of resilience (Cardona et al., 2004). Vulnerability, and hence risk, is socially determined, and Wisner et

al. (2004) therefore conclude that vulnerability is made up of 'the characteristics of a person or group and their situation that influence their capacity to anticipate, to cope with, resist and recover from the impact of a natural hazard' (Wisner et al., 2004, p. 11).

Since risk is a function of both hazard and vulnerability, and hazards are, at least to some extent, known and constant, vulnerability appears to be the main factor that distinguishes between those who suffer loss and those who escape it. A common issue is whether vulnerable people contribute to their own predicament by making uninformed or unwise choices. For example, does one not 'choose' to live in a flood-prone area? This presupposes that choice is available. This is not always, or even commonly, the case. In Africa, Asia and the Pacific, Latin America and the Caribbean, rapid and unplanned urbanisation has placed some 600 million urban dwellers in life- and health-threatening homes and neighbourhoods (Hardoy et al., 2001). For many, the choice to relocate or remove themselves from this situation simply does not exist, leading to a position where disasters, or potentially disastrous situations, are created. Hazards, such as floods, are natural events; however, disasters are not natural. In Latin America, it has been common for some time to define disasters as 'failed development' (Manizales Declaration, 2004).

The IDNDR raised the profile of the social and economic causes of risk and led to a growing realisation that using technological and engineering approaches to mitigate losses deals only with symptoms, not causes. A consensus emerged between the middle of the IDNDR (around May 1994) and the 2005 WCDR that reducing risk requires long-term engagement in the development process.

This international effort to raise the profile of disaster and flag the relationship between disaster and development sees risk management as an integral component of sustainable development. This is reflected in the call by the World Summit on Sustainable Development (WSSD)—held in Johannesburg, South Africa, on 26 August–4 September 2002—for disaster reduction strategies with a two-fold aim: to enable societies to be resilient to hazards while ensuring that development efforts do not increase vulnerability to hazards. The WSSD concluded that:

> *An integrated, multi-hazard, inclusive approach to address vulnerability, risk assessment and disaster management, including prevention, mitigation, preparedness, response and recovery, is an essential element of a safer world in the twenty-first century* (UN, 2002; UN/ISDR, 2003).

Disaster reduction has thus emerged as a core element of sustainable development. Development investments and projects can either increase or reduce vulnerability to hazards. Investments and development activities are almost never risk-neutral. It is at the nexus between sustainable development and policy that the aims of the disaster, development and climate change communities intersect. Risk reduction is the shared objective, but it is the promotion of resilience that offers the opportunity for more holistic and proactive responses.

Adaptive capacity is strongly linked to resilience. The United Nations International Strategy for Disaster Reduction (UN/ISDR) has adopted the term resilience (UN/ISDR, 2001) and defines it with reference to natural hazards as:

The capacity of a system, community or society to resist or to change in order that it may obtain an acceptable level in functioning and structure. This is determined by the degree to which the social system is capable of organizing itself and the ability to increase its capacity for learning and adaptation, including the capacity to recover from a disaster (UN/ISDR, 2002, p. 24).

This definition is similar to that of vulnerability above, but it is applied to an entire socio-technical system, whereas earlier, vulnerability was defined in terms of households and groups. In this similarity lies one plank in a bridge that needs to be built between the conceptual world of the climate change community and that of the hazards community.

Resilience captures what should underpin holistic risk management. By this we mean a paradigm that includes adaptation to climate change, hazard mitigation and sustainable human development, as discussed previously. Resilience does not focus on what is missing in a crisis (needs and vulnerabilities) but on what is already in place (resources and adaptive capacities).

Applying the notion of resilience to climate change impacts is a matter of finding out how people will cope and helping them to identify where help is needed so as to enable, complement and supplement their coping efforts. This involves specific hazard and vulnerability assessments as well as the identification of coping capacities. In MDCs there are already examples of this approach being taken. The UK Climate Impacts Programme (UKCIP, 1998) has began scenario building and is actively attempting to identify what changes are likely to occur, including precipitation, shifts in vegetation, extreme heat events and sea level rises. With regard to the latter, areas have already been identified where managed retreat from coastal areas will be part of the development framework for those locations. In a similar vein, the UK National Health Service (NHS) is using IPCC predictions to undertake studies aimed at protecting the frail and elderly in the event of extreme hot weather, as occurred in 2003, for instance, when deaths in London among people aged over 75 rose by 60% (NHS, 2004). In LDCs, alternative policy focused studies are under way to identify how local people and government institutions are likely to cope with climate-related changes in rainfall, crop yields, agricultural and livestock pests and diseases, river regimes, disease vector habitats (such as that of the malarial mosquito), fresh water and marine fishery productivity, coastal storms and sea level rise (UNDP, 2004b).

Climate change and risk management

We return now to the definition of risk as a function of hazard and vulnerability. Climate-related hazards include more frequent and severe droughts, floods and storms, in addition to a large array of human health hazards and complex biological impacts on the productivity and stability of livelihoods that depend on natural resources. Climate-related vulnerability is the set of social, economic, political and physical factors that determines the amount of damage a given event will cause and also the capacity to anticipate, cope

with, resist and recovery from that damage. Risk to populations arises from the interaction of these hazards and vulnerabilities.

Risk is offset by resilience, and patterns of risk will differ with changing natural hazards driven by climatic variability. More destructive cyclonic storms may become more common (Emanuel, 2005). Longer-term sea level rise will have major impacts on low lying land. Extreme temperatures will heighten the problems of drought-prone areas—there is already evidence that impacts are exhausting the coping capacity of many communities (ADB et al., 2003; UNDP, 2004a; VARG, 2005; Dilley et al., 2005).

When dealing with climate-related risks, the starting point for adaptation measures that build and reinforce resilience is an understanding of current vulnerability to climate variability and extremes (VARG, 2005). Here one must distinguish between short- and medium-term adaptations of livelihood systems and human settlement and the longer-term natural, biological adaptation of ecosystems. Article 2 of the 1992 United Nations Framework Convention on Climate Change (UNFCCC) states that:

> *The ultimate objective . . . is to achieve . . . stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system . . . within* ***a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner*** (UNFCCC, 1992) (emphasis added).

Signatories to the UNFCCC and the 1997 Kyoto Protocol have accepted that climate change brings with it many potential hazards, such as rising sea levels, increased storm and flood frequency, the spread of infectious diseases, declines in biodiversity and reduced availability of food and water. These impacts are a danger to human life and sustainable development. Hence, the logical connections between the UNFCCC and the aims of sustainable development are clear. While the main aim of the convention is the stabilisation of greenhouses gas concentrations at a safe level, and its main method is emissions reduction, recognition of climate change as a cause of hazard adds weight to the efforts of the UN/ISDR and other bodies to address disaster reduction in the context of sustainable development.

Although the UNFCCC argues for the avoidance of dangerous climate change, the *Third Assessment Report* of the IPCC claims that deciding what constitutes dangerous climate change is a value judgment beyond the remit of the IPCC and perhaps of science itself (Smith et al., 2001). Dessai et al. (2001) point out that there is no universally recognised framework or process for determining what constitutes a dangerous level of climate change, and for whom. They conclude that both the external risk (determined through scientific analysis) and internal risk (determined by individual or community perception of insecurity) should play a role in defining dangerous climate change and believe that participatory assessments belong among the tools for identifying what level of climate change is dangerous. One sees here a parallel with the rising importance of community-based, participatory risk assessment when dealing with natural hazards.

The role of capacity

Climate change projections are scenario based and hence contain uncertainties. What constitutes danger will have to be a political decision. In reality, national governments will take the lead in identifying the dangers both to communities and to livelihoods that are likely to manifest and in developing strategies to cope with, and adapt to, changing circumstances. If Dessai et al. (2001) are correct then there is an urgent need to develop the tools that will enable that analysis to be undertaken so that at least any debate will be informed. It is also a priority to build the capacity of civil society to engage in such a national discussion, bringing the diversity of local conditions, impacts, vulnerabilities and capacities to the attention of national leaders. This is particularly the case for poorer nations, many of which are currently experiencing the impacts of climate change. Magrath et al. (2004) observe in *Up in Smoke?* that several African countries are already having to deal with the ramifications of accelerated climate change, not to mention several of the Small Island Independent States (SIDS) (Pelling and Uitto, 2001; Kelman, 2005). There is an urgent need to ensure that socially widespread capacity to evaluate climate change risk is developed.

Earlier we distinguished between risk management in MDCs and LDCs. How will this divide affect the feasibility and quality of national dialogues on climate change? As O'Brien and Read (2004) point out, civil protection in the UK has evolved from a long tradition and is now embedded throughout institutional structures. Thus the UK government is institutionally capable of adopting a proactive approach to a number of long-term problems that climate change will present. Although the all-hazards approach to risk management concentrates on the near future, typically up to 10–15 years, with established institutions and capacities it may be possible to stretch out the model to accommodate the much longer time horizons for climate change: 50–100 years. The same is true of many other MDC governments.

The situation in LDCs is different. Externally assisted capacity-building programmes for disaster risk management do include an institutional strengthening component, but in general these efforts are often narrowly focused on the creation of disaster-specific legislation, administrative arrangements and institutional structures (UNDP, 2004a). They are often centralised and do not necessarily result in enhanced capacity in disaster risk management at the grassroots or local level. The existence of a national disaster organisation in the capital city may represent progress in nations where disaster risk-related organisations and legislation were previously weak or absent. But they may have little impact on risk accumulation processes in remote provinces or districts.

This raises some difficult issues. MDCs are resilient and should be able to cope with climate change, provided that the transformations are not more extreme and/or rapid than IPCC scenarios envisage. This resilience is a direct function of both capacity and economic prosperity. For LDCs, the capacity to cope is much less certain. As Adger et al. (2001) note, equity issues that have often arisen in debates on carbon emissions reduction also need to be addressed in the context of adaptation to climate change. A much clearer focus on capacity-building is needed. This, coupled with greater access to northern markets to stimulate economic development, should begin to tackle the

equity problem and enable LDCs to enhance indigenous capacity to identify climate change-related risks and to develop adaptation and coping strategies.

Capacity-building comes down to resources and commitments to ensure that these resources are effectively utilised. This is a formidable challenge. Many of the richer nations have not as yet met their international development assistance obligations. Hilditch et al. (2005) show that many OECD member states are failing to commit 0.7% of GNI to overseas aid. In 2003, the percentage ranged from 0.15 for the US and 0.20 for Japan to 0.92 for Norway (World Bank, 2005). This shortfall, combined with problems of debt and unfavourable terms of international trade, does not augur well for the LDCs, particularly the least developed, highly indebted countries, as they struggle with climate change.

In such a resource-poor situation, ad hoc, need-driven relief may continue as a response to the increasing impacts of climate change in LDCs, although the rational (and long-run cost-effective) approach would be to invest in building capacity and resilience. A good example is the difference between the millions of US dollars spent by donors on famine relief in Niger during 2005 (a drought situation) and limited donor enthusiasm for Senegal's proposal to build a 'green wall' against the encroaching Sahara Desert—precisely what China has been investing in as it protects Beijing and the 2008 Olympics from the Gobi Desert to the north (Aloisi, 2005). While disaster management has evolved from a relief and response approach to a risk management approach with a greater focus on reducing vulnerabilities (and increasing coping capacities), initiatives aimed at mitigation and prevention are still few and poorly financed. The contrast is striking when compared with what is spent by donors and development banks on relief ('humanitarian assistance'), including post-disaster reconstruction (Yodmani, 2001).

One further concern is the lack of recognition and inclusion of disaster risk in PRSPs. This could result in a situation where developmental activities aimed at tackling poverty could inadvertently create new risks. Of equal concern are post-disaster recovery programmes that rush to re-establish the status quo ante without any evaluation of whether the earlier development activity itself was a factor that increased disaster vulnerability, or whether recovery investments could become a risk factor (Susman et al., 1983; Kreimer and Arnold, 2001; Burton and van Aalst, 2004). The rush to rebuild after the 2004 Asian tsunami and likely rush to repair the damage caused by Hurricane Katrina to New Orleans, US, are cases in point.

Institutional context

There are a large number of bodies—governmental, non-governmental, public and private—involved in disaster management. There are many others that have a direct interest in disaster risk reduction, including the humanitarian and developmental sectors. But the two principal organisations with a mandate to coordinate the effort to reduce the level of disaster risk associated with accelerated climate change are the UNFCCC and the UN/ISDR.

The UNFCCC is a legal entity established by treaty in 1992. Decision-making is the responsibility of the Conference of Parties (COP), a body comprising the signatories to the convention. Protocols agreed by the COP are binding on UNFCCC signatories. COP is a policymaking and implementing body with a focus on mitigation (reduction of greenhouse gas emissions) and adaptation. It is well resourced.

The UN/ISDR is very different. It is a partnership of organisations that have an interest in reducing the risks posed by all hazards and is united and coordinated by a small and poorly funded secretariat in Geneva, Switzerland.

Although the UNFCCC and the UN/ISDR are different, they do have an overlapping agenda: reduction of the risks associated with accelerated climate change. Their approaches are also different. The UNFCCC takes a mitigation and adaptation approach. Although the UN/ISDR is also committed to addressing the root causes of natural hazard risk in theory, in practice, member nations have emphasised preparedness and only to some extent have they built on local knowledge and capacity (that is, resilience). In actual fact, the work of both the UNFCCC and the UN/ISDR suffers from institutional weakness. Institutional weakness at the national level can prevent effective communication between those parts of government that should cooperate on disaster management and climate change. Institutional weakness may also hinder effective dialogue with those communities most likely to be affected by climate variability.

At the international level, cooperation between the UNFCCC and the UN/ISDR has so far been limited to information exchange. Since they have a shared agenda, more cooperation should be possible. The UNFCCC has greater resources. Could these not be shared with the UN/ISDR in programmes of common interest? For example, they could develop a common model of risk management predicated on capacity-building and resilience. The UNFCCC could use resources and mechanisms available through the Special Climate Change Fund. One recent decision taken by COP9 supports 'capacity-building, including institutional capacity, for preventive measures, planning, preparedness and management of disasters relating to climate change' (COP9, 2002).[3] In this particular matter, the UNFCCC has the resources, while the UN/ISDR has the network and capacity.

Closing comments

A new approach is needed to underpin the incorporation of risk management into work on climate change and the introduction of climate change into natural hazards and development planning. The approach needed is one that is capable of dealing with the long-term transformations that climate change may bring and the ways in which people respond, both at the national, regional and local level. The key concepts in that new approach should be capacity-building and resilience. We have shown that comprehensive risk management, as it has evolved in the field of natural hazards planning over the past 20 years, provides the basis for such a new paradigm. A conceptual bridge exists when one considers the shared understanding of risk as a function of hazard and vulnerability, and when, in addition, one considers the conceptual and practical overlap between notions of vulnerability and resilience.

Adaptation to climate change may involve some very difficult political choices. For instance, long-term changes to land use are likely to be required (affecting agriculture and forestry, the use of coasts, estuaries and river resources and settlement patterns and infrastructure). It may be necessary to instigate a process of managed retreats from those areas that will become unusable, involving relocation to areas that offer security and opportunity. To deal with such serious matters, national decision-making will require strong, sustainable and accepted institutional structures and a population and civil society educated in the issues and alternatives.

There are examples of proactive approaches to the long-term challenges that accelerated climate change presents. But LDCs are unlikely to have the capacity or resources to respond similarly. Risk management in MDCs has its focus on risk reduction and prevention. For LDCs, the focus has generally been on relief. This difference reflects economic disparity. Risk management cannot, of itself, address the underlying causes of poverty. But if approached from the standpoint of resilience, it can help to build those structures that will enable a greater degree of self help. It is about helping people to help themselves. The mechanisms, resources and capacity do exist. The challenge is in trying to find the means of developing closer linkages, such as between the UNFCCC and the UN/ISDR.

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Endnotes

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[2] The recovery of New Orleans, US, from the catastrophic impacts of Hurricane Katrina (August 2005) may turn out to be an exception.

[3] Decision 5/CP.9, Section 2c.

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Appendix 4

The future of nuclear power in Europe: a response
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The future of nuclear power in Europe: a response

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Two interlinked and complex problems face energy policy-makers: future energy supplies and climate change. The choices made on energy mix will lock development pathways for some considerable time ahead. Climate change is a challenging problem. Decarbonising the energy system requires sustainable and environmentally friendly technologies that work within the context of the planetary environment and do not cause "collateral damage". Several approaches are available. But nuclear power is an unsustainable technology that has already caused "collateral damage" and will leave a toxic legacy of waste, for which there appears to be no solution. Including nuclear in a future energy system is a step in the wrong direction.

Keywords: Energy policy; Climate change; Cost; Security; Scale; Renewable technology; Nuclear power

1. Introduction

The focus of future energy policy should be on the type of energy services needed; for example, communications, space heating and transportation, as opposed to thinking about a particular energy supply. A focus on demand, not supply, should underpin approaches to energy systems. The energy system should contribute to reducing climate change risks. Ensuring energy security and price stability are vital. The dimensions of energy policy and planning are summarized as service- and demand-led, with minimal or no greenhouse gas content.

The choices are stark. Traditional fuels are becoming increasingly scarce and prices more unpredictable. The need to reduce greenhouse gas emissions is becoming more urgent. Whatever route is chosen will dictate development paths for some time to come. This response argues that nuclear is a step backwards, locking Europe into an unsustainable energy path that will leave a toxic legacy for future generations. Doing nothing or relying on the 'invisible hand' of the market would be irresponsible. The choice is between a return to a nuclear past or forward to a renewable and efficient future.

There are many types of renewable sources that deliver electrical power, space and water heating and transport fuels. Many of these technologies are new and inefficient. Further development offers scope for efficiency gains, a claim that cannot be made by many of the mature energy technologies. Many end-use activities are inefficient, for example the incandescent

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light bulb with an overall efficiency of a few percent over the whole cycle. There is huge scope for improving end-use efficiency that offers further progress in de-coupling energy use and development and improving quality of life. Renewable technologies have low or no carbon content. This will contribute to reducing climate risks. Renewable energy systems can exploit indigenous sources, lessening dependence on imported supplies. The renewable path offers the possibility of a new energy paradigm, leading to a sustainable energy future.

Technological development, like evolution, offers options but many are dead-ends. Trying to predict which innovation will succeed or fail is problematic. Development is not a linear progression and often 'surprises' or disruptive innovations take development along paths not previously envisaged. We do not argue for a particular technological solution to address current issues, but where there is experience of a particular innovation we can learn from that history to evaluate whether or not it is worth revisiting. Nuclear power has a history that suggests it is not worth revisiting.

2. The real costs of nuclear power

Nuclear projects have never been delivered on time or within budget. They are expensive and prone to cost overruns. As opposed to producing power 'Too cheap to meter', they have in fact led to decommissioning and clean up costs that are arguably 'Too great to measure'. Unwillingness by the private sector to engage in nuclear production unless the high level waste management is underwritten from public sources has been signalled through the European and American stock markets.

Even if a decision in favour of nuclear energy was made now, it could be as long as 25 years before any benefits accrue [1]. This raises questions about the wisdom of opting for an energy technology that is, at best, problematic in terms of costs. Fells draws on cost data from a study by the Royal Academy of Science and concludes that nuclear is on a par with gas and cheaper than coal and wind power [2]. The British Wind Energy Association (BWEA), however, disputes the figures and claims that onshore wind power is cheaper than new nuclear build [3].

A more authoritative study produced jointly by the Organization for Economic Cooperation and Development (OECD), the Nuclear Energy Agency (NEA) and the International Energy Agency (IEA) concludes there is no overall technological winner and that the investment choice must take into account a range of other factors, such as security of supply, risks and carbon emissions, before arriving at investment decisions [4]. *The Economist* refers to a study into renewables by Shell Renewables in 2004 that demonstrated that both wind and solar technologies were price competitive if they were of the right scale and in the right locations. This was against a background of oil prices of US$40 per barrel – today they are around US$60 per barrel [5]. And British Gas announced a 22% increase in gas and electricity prices from the 1 March 2006, citing soaring prices and distortions in the European market [6]. What is clear is that basing an argument on current prices as a means of supporting a particular technology is short-sighted. Predicting future prices of energy supplies over the medium to long term is fraught with difficulties. The further into the future the projection, the less certain is the outcome.

But the speed of development of renewable technologies is an important consideration when considering investment risks. Lead-time, the time from point of order to delivery of product, is the key difference between nuclear power and the new and renewable technologies. For renewables, the lead-time is short, some one to two years for wind and the risks more quantifiable. Costs are falling and will continue to do so [7]. For nuclear the lead-time is long, some 10 to 20 years, and the risks less quantifiable. Hedging these nuclear risks will probably require

being 'locked' into long-term contracts underpinned by public money. Essentially the nuclear pathway is unsustainable. It will mortgage our children's future with no certainty that the assumptions about costs, fuel availability and decommissioning will bear any relationship to the original estimates.

And it is the issue of decommissioning that is the most problematic. The Royal Academy claims that its figures for nuclear power include the costs of decommissioning. Their sincerity is not doubted. What is in issue is the value assigned to that cost assessment and how reliable it may be in 50 to 100 years, the timescale when new capacity may be decommissioned.

From a cost–benefit perspective, nuclear is a poorer option than promoting renewables or improving efficiency. It would be prudent to take a least-cost approach rather than a benefit-maximizing approach when key costs are unknown and unknowable [8].

3. Issues of scale

Nuclear is a large-scale leviathan approach. Development paths are moving to smaller, flexible, smarter and decentralized approaches. A large-scale nuclear programme would drain funds, people and resources from developing alternative approaches. And during the period before the proposed nuclear power becomes available, is the strategy to do nothing and rely on imported fuels to be used in aging, and by implication, inefficient power stations?

Cheap coal and economies of scale post-Second World War saw an era of gigantism in the electricity generation sector. Thermal stations, whether coal fired or nuclear driven, are essentially kettles for raising steam to drive turbines, and are limited in efficiency by the laws of thermodynamics and safety concerns. To maximize investment return, coal stations need to be near to a fuel source: nuclear is generally remote from population centres for safety reasons. Both need to operate at a constant, or base, load. Because of location, grid systems are required to connect power stations to customers.

These are inflexible systems, vulnerable to a range of threats, such as technical faults, operator errors or interruptions to fuel supplies. Smaller more efficient and flexible systems, typically using gas as a fuel, are becoming the norm. In the UK, privatization has brought structural changes, with the displacement of the vertical integrated system with smaller sectors focused on generation or distribution. In short, the system has abandoned gigantism. Changing customer needs have seen the introduction of autonomous systems, particularly for those that require uninterrupted supplies [9].

Fells asks why countries such as the UK and Germany are phasing out nuclear, and answers the question by pointing out that they are coming to the end of their useful lives. This is not disputed. But the argument must go further and accept that nuclear stations have come to the end of the useful technological lives. In a world of rapidly changing technologies, nuclear power is unable to change, for example to smaller and more flexible systems, perhaps even mobile systems that can be quickly deployed where needed. Nuclear power is a niche player in an electrical system that is undergoing massive and rapid change, and in the longer term, will no longer require those niches.

There are those that argue that pursuing a nuclear route is worthwhile because of the prospect of nuclear fusion in the future. Nuclear fusion is seen as the Holy Grail of energy production – clean, virtually limitless power. The international community is investing some £12bn in a 30-year research programme for a technology that Fells, a clear supporter, only gives a 50% chance of success [1]. This raises the question of what could be achieved if this money were spent on researching alternatives. Such a programme would start from a position

of having alternatives that work, such as wind and solar, and giving those a greater than 50% likelihood of success.

The raw materials for the fuel for a reactor are not indigenous to the UK and have to be imported. This increases the problems in terms of energy security. Nuclear is not a renewable technology, unless the dangerous fast breeder route is incorporated. Supplies of fuel are limited. The purpose of a new energy policy should be to reduce dependence on imported and non-renewable supplies.

Developments of any kind are never risk free. Nuclear is no different. However, it is the consequences of a nuclear accident that are of concern. With greater numbers of reactors and waste storage facilities the probability of an accident, whether accidental or instrumental, will increase. Many nuclear facilities are located near to the sea. What defences are needed to prevent inundation from climate change related sea level rises? Nuclear installations are an obvious target for future terrorist attacks. What are the future costs of additional security and how long will they be needed? None of these issues has been fully described let alone faced.

Is there a case for allowing nations such as Iran to pursue the nuclear option? The current position via the Nuclear Non-Proliferation Treaty signatories and the IEA and UN system appears to be that there is not. How will the international community deal with such issues if more and more nations decide that nuclear is the only way they can cope with both greenhouse gas reductions and ensuring future supplies. Fells is strangely quiet on this issue. Can nuclear energy be properly assessed if such issues are excluded by its advocates?

4. The carbon challenge

Failing to move, at least, in the right direction over global warming would be an abnegation of responsibilities to future generations and possibly catastrophic. Kyoto, though modest, is welcome. But the real benefits of the climate change debate and the tussles over Kyoto, is that an international dialogue is now underway about energy futures: ironically, it is the environment debate that gives us the outline of energy policy. Although the international community recognizes the dangers of climate change, there is no value stated for greenhouse gas concentrations that if exceeded would be dangerous [10]. The accepted wisdom appears to be that we need a 60% reduction in greenhouse gas emissions if we are to avoid dangerous climate change. This may be a useful target, but what is clear is that the experiment with the atmosphere needs to be ended quickly. The question is how?

Nuclear accounts for some 19% of UK electricity production and provides less than 4% of UK final energy consumption. Making significant inroads to carbon reduction needs an approach that includes all energy uses. For example, the lack of insulation in social housing results in the production of some 2.5 million tonnes of carbon dioxide per annum [11]. Data given by the UK Environment Minister, Elliot Morley, reveals that electrical equipment in sleep mode uses roughly 7TWh of energy, the equivalent of two power stations, and emits around 800,000 tonnes of carbon [12]. It hardly makes sense to embark on a nuclear program to supply power for standby purposes.

Reducing greenhouse gas emission levels by 60% by 2050 will be challenging. Research undertaken by the Tyndall Centre shows that this target could be met through efficiency measures and renewable technologies [13]. This proposed change requires intervention by government. The Tyndall Centre argues that the government needs to implement a phased programme of stringent minimum efficiency standards and increased deployment and development of renewable alternatives.

In terms of development of renewable capacity the most successful approaches are seen where legislation requires utilities to purchase electrical power from renewable sources. Where direct market intervention has occurred, public take-up has been impressive, for example in Denmark and Germany. Where targets have been set, the take-up has not been as good; for example, the UK. Despite opposition from the nuclear and coal industries, public opinion in Germany has supported alternative approaches and the schemes implemented have placed Germany second to Denmark in terms of the wind power industry and second to Japan in terms of the photovoltaic (PV) industry [14]. This shows that the European Union can innovate; and if so, why not?

Nuclear power is not a carbon free option. At point of production it does not emit greenhouse gases. But over its lifecycle it does. In general it is reasonable to state that every energy technology will have some adverse impacts when viewed over the whole lifecycle. The challenge is selecting those technologies that have the minimal impact or impacts that are reversible.

5. Energy futures

The debate in the UK and the EU is increasingly focused on two main issues. First, is the future of energy supplies. Projections show that more and more of these supplies will be imported: there are concerns that geo-political shifts may impact the security of these supplies [15]. Second, international commitments to reduce greenhouse gas emissions. Though greenhouse gas emissions did fall for some time in the EU, the demand for energy did not. Since 2000, emissions have begun to rise and it is possible that EU international commitments may not be met, unless additional measures are introduced [16]. The demand for energy seems unstoppable with forecasts up to 2030 by the EU and IEA of either 0.5% or 0.7% annual increases [17,18].

This anticipated demand raises the question of the role of nuclear. We argue that a focus on one supply side aspect of the energy system misses the point. The interrelated issues of energy and climate change are complex but not intractable. The dimensions of future energy systems can be simply expressed as:

- No adverse interference with the global climate system.
- Wherever possible using indigenous resources to minimize geo-political risks.
- Appropriate to needs and long-lasting.
- Work within the context of the environment.

What is clear is that there will be a single solution to the energy and climate change problem. The era of the dominance of hydrocarbons is coming to end. Renewables appear to be the only energy sources with the diversity to meet our many energy needs. Typically they have low environmental impacts in construction, use and decommissioning. Renewable technologies use the natural energy flows of the planet generated by the sun, gravity and the internal heat of the planet. This is a benefit from a climate change and environmental perspective. Renewable technologies are evolving rapidly and can be easily installed and quickly removed at end of service with little need for remediation or clean up. Hydrocarbon and nuclear technologies create significant environmental damage and leave a toxic legacy that is both time consuming and expensive to remedy.

Considerable progress has been made in developing renewable capacity. Table 1 surveys some of the developments in solar technologies. What can be derived from the table is the

Table 1. Renewable solar technologies.

Technology	Typical characteristics	Typical energy costs (cents/KwH)	Cost trends and potential cost reductions
On-shore wind	*Turbine size:* 1–3 MW *Blade diameter:* 60–100 m	4–6	Costs have declined by 12–18% with each doubling of global capacity. Costs are now half those of 1990. Turbine size has increased from 600–800 kW a decade ago. Future reductions from site optimization, improved blade/generator design, and electronics.
Off-shore wind	*Turbine size:* 1.5–5 MW *Blade diameter:* 70–125 m	6–10	Market still small. Future cost reductions due to market maturity and technology improvement.
Solar PV (module)	*Cell type and efficiency:* single-crystal: 17%, polycrystalline: 15%, thin film: 10–12%	-	Costs have declined by 20% for each doubling of installed capacity, or by about 5% per year. Costs rose in 2004 due to market factors. Future cost reductions due to materials, design, process, efficiency, and scale.
Rooftop solar PV	*Peak capacity:* 2–5 kW	20–40	Continuing declines due to lower solar PV module costs and improvements in inverters and balance-of-system components.
Solar thermal power (CSP)	*Plant size:* 1–100 MW *Type:* tower, dish, trough	12–18 (trough)	Costs have fallen from about 44 cents/kWh for the first plants in the 1980s. Future reductions due to scale and technology.
Hot water/heating			
Solar hot water/ heating	*Size:* 2–5 m^2 *Type:* evacuated tube/flat-plate *Service:* hot water, space heating	2–25	Costs stable or moderately lower due to economies of scale, new materials, larger collectors, and quality improvements.
Biofuels			
Ethanol	*Feedstocks:* sugar cane, sugar beets, corn, or wheat (and cellulose in the future)	25–30 cents/litre gasoline equivalent	Declining costs in Brazil due to production efficiencies, now 25–30 cents/equivalent-litre (sugar), but stable in the United States at 40–50 cents (corn). Other feedstocks higher, up to 90 cents. Cost reductions for ethanol from cellulose are projected, from 53 cents today to 27 cents post-2010; modest drops for other feedstocks.
Biodiesel	*Feedstocks:* soy, rapeseed, mustard seed, or waste vegetable oils	40–80 cents/litre diesel equivalent	Costs could decline to 35–70 cents/litre diesel equivalent post-2010 for rapeseed and soy, and remain about 25 cents (currently) for biodiesel from waste oil.
Off grid energy			
Biomass gasifier	*Size:* 20–5000 kW	8–12	Excellent potential for cost reduction with further technology development.

Table 1. (*Continued*).

Technology	Typical characteristics	Typical energy costs (cents/KwH)	Cost trends and potential cost reductions
Small wind turbine	*Turbine size:* 3–100 kW	15–30	Moderately declining with technology advances.
Household wind turbine	*Turbine size:* 0.1–1 kW	20–40	Moderately declining with technology advances.
Village-scale mini-grid	*System size:* 10–1000 kW *Options:* battery backup or diesel	25–100	Declining with reductions in solar and wind component costs.

Source: Adapted from REN21 [22].

range of energy services that are available: electricity, gas, automotive fuels, hot water and space heating. Many of these technologies are still developing and costs are still falling. For example, PV technology is now as cost effective as many traditional building claddings. Incorporating PV into buildings has generated many innovative urban building designs, for example an office building at Doxford International Business Park, Tyne and Wear, UK, that has a 60 m long inclined south facing PV façade and many innovative internal features designed to minimize energy use [19]. Renewable capacity to generate electricity, hot water and space heating can be embedded in the urban environment. Urban areas can be both generators and users of power. With innovative design of the built environment, many energy needs can be realized near to the point of use. Zero Emission Developments (ZEDs) that incorporate renewable capacity and high thermal insulation standards mean that the urban fabric can contribute to its own energy needs [20]. Making our technologies smaller, smarter and more efficient can help to de-couple further the links between development, quality of life and energy use.

The longer term offers some interesting possibilities. Embedding generation in the built environment and encouraging co-operative ownership of renewable capacity has made a striking impact in Denmark and Germany in both take-up and awareness of energy issues [21]. In the longer term, moving towards smaller, smarter and autonomous systems implies a more democratic structure for future energy systems. This is a far more resilient approach to energy systems than the large-scale monopolistic top-down approach of the past. Reconnecting citizens to the energy resources they need is a way to provide knowledge, understanding and responsibility. In the increasingly informed world of today it makes sense for as many as possible to be actively engaged in solving the related problems of energy security and climate change. This poses the question of whether governments will have sufficient will to put in place policies that will run counter to established interests. A first step would be to start to transfer subsidies from hydrocarbons to renewables. Intervention by governments is needed to support the growth of the renewable sector. Worldwide, up to 37 governments have enacted renewable energy feed-in laws; and these have encouraged the market in those nations [22]. The United Kingdom needs a similar approach.

For the future, hydrogen has the potential to be an effective energy carrier. When used as fuel, in either a fuel cell or combustion process, it is neutral from a climate change standpoint, as it recombines with oxygen to produce water as a waste product. Fuel cell technology is undergoing rapid development. The challenge is to find ways to harvest the abundance of hydrogen in the environment. There are two main routes. The first uses renewable electricity sources such as PV, wind and hydro to produce hydrogen by the electrolysis of water. The

second uses reforming technologies, for example by stripping hydrogen from methane. Reforming technologies are not acceptable from an environmental standpoint because of carbon emissions and the use of a non-renewable fuel source [23,24].

The efficiency of electrolysis is fairly high, around 70%, but the challenge is to develop methods of effective storage and transmission of hydrogen to the point of use. There is considerable effort to produce both fixed and mobile hydrogen fuel-cell technologies. A study conducted by Ulf Bossel, an independent consultant, for the European Fuel Cell Forum shows that currently hydrogen powered fuel-cell vehicles are not as efficient as diesel, including bio-diesel fuelled vehicles, and hybrid electric vehicles. The study concludes that hydrogen offers potential for short predictable journeys because of the current problem associated with fuel storage and lack of infrastructure [25]. Initiatives such as the Hydrogen Highway in California testify to the depth of interest and the potential that hydrogen fuel cell technology holds for the transportation sector in the longer term [26]. Problems of storage and infrastructure are likely to be attacked because of the enormous potential hydrogen fuel cell technology offers the automotive sector. This should be seen against the background of US$1.2bn investment announced by President George Bush in 2003 in hydrogen fuel cell technology and related infrastructure [27]. A report on the development of hydrogen automotive technologies, disseminated in December 2005 for public consultation, indicates that commercialization of these technologies could begin by 2020, with the transition to a full hydrogen economy by 2040 [28].

Similar developments for stationary fuel cells that can be used for either commercial or domestic purposes could see the transformation of the energy sector. Embedded generation offers the possibility of locally generated hydrogen. The potential for autonomous systems either at the household level or community level presents a new paradigm. The purpose of this paper is not to speculate on what may be, but to argue that the debate on energy futures should not advocate one single supply option. The issues are too complex to exclude hope and true power for man's future by excluding energy options in favour of one imposed system. Renewable technologies point to a wholly different future for the energy sector. How this will develop in the long term is open to speculation. But development – not distortion – is the point.

We make no special plea for a particular policy and technology route. There are many options available, each with its advantages and disadvantages. The role of science, scientists and technologists is to be objective in evaluating the potential of differing technologies and techniques, so that policy-makers face credible options. The key issue is openness to data.

6. Advocacy subject to science

Fells is a proponent of nuclear power; but the conclusions that come from such advocacy are all debatable. It is not just the issue of supply options, where many engineers would significantly disagree with his conclusion that nuclear power is the answer. Fells again urges a single decision to a series of complex questions. This is rather like playing golf with one club, or driving a car in one gear.

Nowhere is the complexity greater than the issue of high-level waste. Of the three strategies of disposal, namely into space, into the sea or deep burial on land, only the last option is morally optional. But geologists cannot predict earth stability. And ecologists are finding life forms in very acidic and pressurized deep environments that will not allow them to make accurate assessments of potential pathways of radioactivity that could substantially alter the

gene pool. More fundamentally, the science of economics cannot predict an accurate price for the storage of caesium 123, with a half-life of 10,000 years, with any degree of accuracy. These are not failures of science but points raised by robust science. The question of energy futures is not solved by the one answer of nuclear energy.

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Appendix 5

Energy, Poverty and Governance.
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Energy, poverty and governance

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To make any progress towards achieving the Millennium Development Goals (MDGs), a new approach to energy systems for the poorer nations is needed. Equally, a new approach to energy should shape thinking in the developed and industrializing world about energy futures. All countries need to have access to clean, affordable and reliable energy services that do not exacerbate the climate change risks. A global energy policy will emerge, but by the backdoor of environment policy. This article is in three parts. First, it examines the problem in the developing world. Second, it -establishes a framework for evaluating the approach to energy systems. Third, it argues that technology transfer as commonly practised is not an appropriate vector. In concluding, this article sets out an approach at international level.

Keywords: Energy; Governance; Poverty; Resilience; Sustainable development

Re-thinking energy systems

The United Nations Commission on Sustainable Development (UNCSD) views on access to affordable energy services are a starting point for thinking about energy systems [1]. An energy system must deliver the appropriate service, at point of need, for example, light or heating or motive power, and should exhibit the following characteristics:

- It should not contribute to climate change. It should use renewable sources or, at minimum, be carbon neutral.
- It should enhance livelihood strategies. Women, in India, regularly spend between two to seven hours each day collecting fuel for cooking and, in rural sub-Saharan Africa, many women carry 20 kilograms of fuel wood an average of five kilometres every day. This time could be spent on childcare, education, socializing and income generation [2].
- It should be democratic. Ownership and management should be local.

This will enhance local capacity to make choices and take actions based on local needs and circumstances that will strengthen local governance.

A system approach is vital. Thinking about energy technologies often focuses on the supply side [3]. System thinking recognizes that users are a component. But treating users as just a

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single point in the energy matrix ignores their multiple roles in managing and developing the system. People know the kind of energy services they need and the purposes for which they need them. To meet real needs, ownership and management must be part of the energy system.

Re-thinking energy systems also means re-thinking technology transfer. Despite years of technology transfer, there is little change in the lives of billions of people who are excluded from access to and control of old and new technologies alike. Worldwide, one billion people still have no access to safe water, 2.4 billion have no sanitation, and 840 million remain chronically undernourished. As for energy services, about one quarter of the global population, 1.6 billion people, have no access to electricity and 2.4 billion people rely on traditional fuels such as wood, charcoal or dung as their principal source of energy for cooking and heating. Traditional fuels are literally killing people as 2.5 million women and children die each year through indoor air pollution from cooking fires [4].

There are also growing burdens on the environment. Problems of environmental degradation arising from commercial logging and agricultural colonization have forced many of the rural poor to search for employment in towns. This has accelerated the rate of urbanization; which, especially in semi-arid areas, is increasing pressure on the local biomass resource [5–7]. As urbanization continues, this will increase the pressures on biomass resources resulting in further environmental degradation [8].

Sustainable solutions to energy poverty are needed. Technology transfer alone is insufficient to promote sustainable approaches unless there is local control over use and development is integrated into the process [2]. Local governance is a necessary component of a sustainable approach. Though technological capacity for capturing renewable resources may be advanced in the developed world, the needs assessment and overall design should be part of the capacity building process of those who will both use and benefit from the intervention.

Governance is a key issue in technology transfer as the type of technology deployed should depend upon local knowledge, needs and circumstances. Some generalizations can be made about type and dimensions. For example, in areas with ample sunshine, solar technologies will dominate and in areas where water power is available then small scale hydro will be more likely: dimensions will include efficiency, appropriateness to need, reliability, adaptability, reparability and ease of use, but the most crucial is the involvement of local people in their development, implementation and operation.

Resilience is associated with sustainable approaches. Sustainable development recognizes that human progress should avoid increasing risks to both human populations and the environments that support them. Yet often developments both cause disastrous events and increase risks [9]. The term resilience has gained a broader and deeper meaning in the sustainable development arena [10–13]. The disaster management community have made resilience central within the overall framework for reducing disasters. The international agendas for sustainable development and disaster reduction are converging. The link to the Millennium Development Goals (MDGs) MDGs is now recognized throughout the international community and is articulated in the Hyogo Declaration of the United Nations International Strategy for Disaster Reduction (UN/ISDR) 2005 World Conference:

> 'We recognize the intrinsic relationship between disaster reduction, sustainable development and poverty eradication, among others' [14].

Pre-disaster planning and a culture of prevention and resilience are components at all levels to reduce risk. Actions are framed by ideas of governance, risk identification and reduction and preparedness [14].

The MDGs see sustainability as the means of reducing human risk to development patterns. Resilience therefore is integral to reaching the MDGs. Without the ability to respond and adapt to the challenges that development can present, we will be locked into patterns of spiralling decline. Applying resilience as a characteristic to global efforts recognizes that we build upon a flawed base. For example, exploitation of hydrocarbon fuels has contributed to the current episode of climate change, meaning that future developments will have to factor in that fact in their interventions and ensure they do not exacerbate the problem.

Climate change will lead to changes in precipitation and hence vegetation patterns [15]. The IPCC Fourth Assessment Report appears to emphasize the importance of variability in climate risk, rather than mean changes in temperature. This variability in developing countries will be associated with increasing droughts, floods and storm surges. There should be greater emphasis on the pre-disaster planning for natural hazards with an emphasis on resilience and recovery of livelihood systems. The energy sub-system of livelihoods also needs an emphasis on resilience [16,17]. A sustainable, resilient energy system implies appropriate technology and the indigenous capacity to adapt to challenges. Resilience and governance are intertwined; not only for energy systems, but in a broader and holistic manner. Indicative research results from field studies undertaken by the authors show that to meet changes consequent from a warming climate, capacity building strategies must be made resilient to make communities self-reliant.

Approaches to energy in addressing energy poverty: from theory to practice – the case of electricity to guide development

In thinking of the development of energy technologies in developing nations, the accepted progression is that of the energy ladder [18]. Households progress through a series of steps from biomass to kerosene and gas and eventually onto electricity. In the new millennium, where there is considerable doubt about the long-term future of carbon-based fuels such as kerosene, both in terms of their availability and contribution to anthropogenic acceleration of climate change, it seems nonsensical to assume the same progression for the energy poor. Ladder 1 in figure 1 illustrates the conventional model. But the reality is that progress in less developed countries does not lead to the abandonment of fuel supplies. Because supply systems, distribution technologies, the fuel supply itself and the end-use technologies can suffer from delivery breaks and market distractions, a rich person will have energy technology options rather than a consolidated option of one fuel. Parallel to this, solar electrification in the developing world is being used by rural middle classes for connective activities such as television, radio and cell phone charging. The challenge is to shift this towards poverty alleviation, sustainable development and appropriate technological development.

For those currently at the biomass level of Ladder 1 then a different approach is needed. The Step Change shown by the shaded area in figure 1 represents a shift from biomass to the first step on Ladder 2. This is the area where interventions are needed by developmental programs to accelerate the change from traditional fuel sources to renewable and sustainable approaches represented in Ladder 2 [19]. Ladder 2 then represents a new development pattern – different from that of Ladder 1. First, it assumes that the technologies used throughout the ladder will use renewable resources. Second, the end point assumes the development of autonomous small-scale grid systems. The overall goal of this approach is poverty alleviation but in conjunction with the development of governance expressed through the ownership, management and development of the energy system.

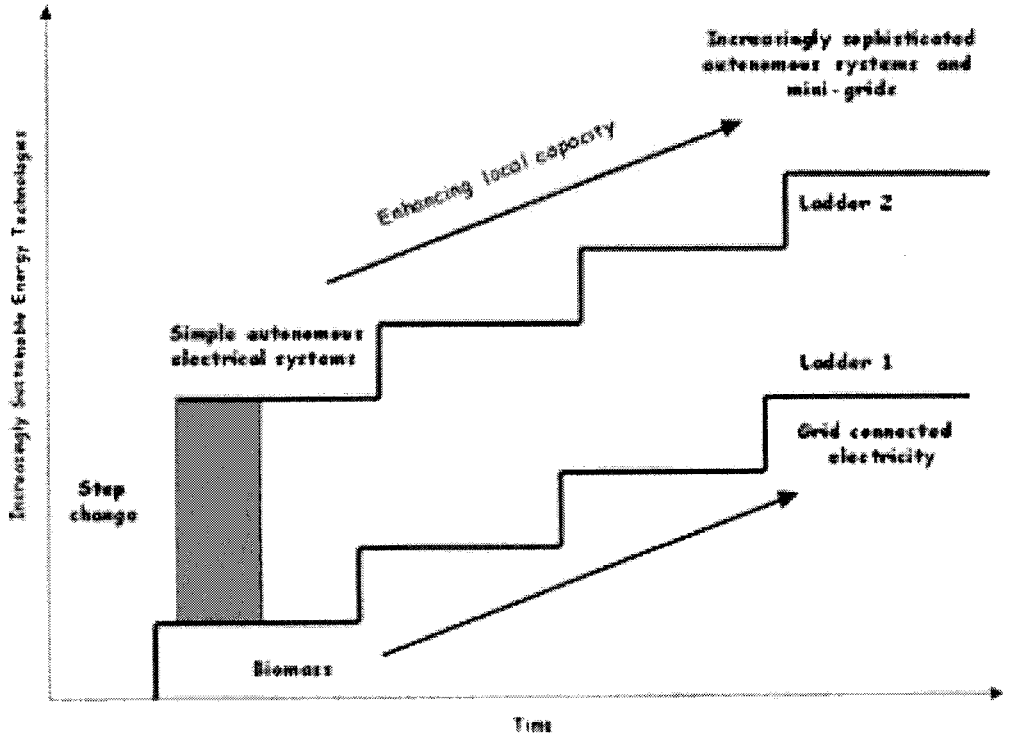

Figure 1. Alternative energy ladder approaches.

There are three reasons underpinning this logic. Firstly, renewables are diffuse, scattered and can be intermittent. They are not best suited to a large-scale interconnected grid system that is predicated on large production units located near to fuel resources, for example, a coal-field or a gas network terminal. Attempting to extract an equal power output using renewable energies from the same area as that occupied by a nuclear station is impossible, except with a wider footprint required to gather and process the fuel and resources to construct the power station. Hence, a different mindset is needed when considering renewables. They are diverse, scattered and can be difficult to capture. Despite these problems, renewable energy is clean and continuous.

Second, there are questions about the longevity of large-scale interconnected approaches. Mycle Schneider, director of the World Information Service on Energy (WISE-Paris) writing for the World Wide Fund for Nature (WWF) argues that the concept of large grid connected systems may soon be obsolete, perhaps within 20 years. This does not, however, account for the position in Western Europe where the UK national grid and the French electricity system are capable of supplying part of a pan-EU supranational grid.

Schneider cites the advantages of small-scale systems as low specific capital and maintenance costs, high investment flexibility and low grid losses [20]. There are further advantages of small systems, particularly for developing countries. David Appleyard claims that in Latin America, where around a third of all people have no access to mains electricity, distribution companies are estimated to be losing around 40% of electricity due to theft, poor maintenance and inefficiency. Massive losses are also to be found in the distribution networks of Africa, South East Asia, the former Soviet Union and large swathes of Eastern Europe [21].

Seth Dunn points out that though large-scale systems may be suited to the needs of industrial suppliers, they are not always suited to many of the new industries beginning to dominate the commercial sector of the developed world. Many hi-tech organizations depend upon uninterrupted supplies of electrical power. They are vulnerable to power surges and even very short interruptions (for example a hospital). An increasing feature is the use of stand-alone power supplies that either possess sufficient capacity to withstand a power outage of several hours or days or be completely independent of the grid [22].

These decentralized micro-system approaches act to reduce vulnerability through increasing diversity in power supply options. As a model for technology development they have several attractive features. Their scale allows them to act as a suitable vector for the application of renewable technologies. The intermittent nature of renewables requires the system approach to have inbuilt diversity. It should be capable of capture from a range of inputs and have the capacity to switch from one input to another, or to use excess production to produce stored capacity that can be accessed when the renewable source cannot provide sufficient input.

Third, autonomous systems, operated and owned locally, can act as a vector for developing governance. Smaller systems offer the flexibility to use local resources and to develop local human capacity. Essentially, they are democratic. Systems of this type are already operational, for example, on the Hebridean Isle of Unst where unused power from a wind turbine is used to generate hydrogen that powers fuel cells during periods of low or no wind [23].

Case studies of small-scale renewable projects in the developing world have demonstrated how successful this approach can be. There are, however, lessons learned from these projects that should be incorporated into future deployment strategies. These are summarized as:

- Needs assessment: ensuring that a clear understanding of energy needs is generated.
- Energy mapping: knowing what local energy resources exist.
- Support systems (technical, human and financial) are needed.
- Appropriate level: defining the entry level [24,25].

What is apparent from the case studies is the important role of microfinance schemes, owned by the community, in ensuring the long-term success of small-scale renewable energy projects. It is not a question of technological capacity but one of creating the right institutional and market arrangements to make it work. Tackling energy poverty, however, requires projects to have the right dimensions and characteristics if they are to succeed in the long term. Table 1 summarizes dimensions and characteristics for sustainable projects.

The question that needs to be addressed is what modalities are best to realize this.

Bridging the energy gap: what do developed countries offer?

The main thrust for bridging the energy gap between rich and poor is through technology transfer. But technological development is rooted in the socio-economic systems in which it has evolved and developed. Energy systems in the developed world can be characterized in two ways. First, in terms of scale, they are large and complex. This leads to problems of fragility and vulnerability. The issue of vulnerability of energy systems, however, is not new. Lovins and Lovins (1982) describe the vulnerability of the US energy systems as an:

> 'unintended side effect of the nature and organization of highly centralized technologies' [26].

Table 1. Features of sustainable energy systems.

Dimension	Characteristics
Appropriate	Matched to the needs of the community and to cultural norms
Exploits indigenous renewable resource	Exploits local renewable resources such as water, solar, wind, geothermal, etc.
Capacity enhancing	It should enhance local capacity and time to devote to other productive endeavours such as income generation, education, socializing, etc.
Adaptable	It should be capable of expanding and developing along with the capacity of the community
Easy to maintain and repair	Ease of use and repair freeing the local community from dependence on outside expertise and distant supply lines
Upgradeable	They should be able to integrate technological improvements in a seamless manner appropriate with the development of capacity of the users

The fragility of power systems has been illustrated recently with power failures in Greece, USA and Canada during 2003 and Italy in 2004 caused by a series of technical problems. Power systems are vulnerable to extreme weather events; for example, the ice storms in Quebec, Ontario and the northeastern United States of 1998 that left three million people without power, and Hurricane Katrina that caused severe damage to power infrastructure in New Orleans during 2005. Extreme weather events driven by climate change will make power systems more vulnerable and, as the IPCC predicts, extreme weather events are likely to occur more frequently [15].

Energy systems in the developed world depend upon the availability of energy supplies, which are vulnerable to global geopolitical forces. Interruptions to supply can lead to economic shocks and concerns have been raised within the European Union (EU) regarding the security of energy supply. The EU Green Paper on Energy Security points out that 70% of the EU energy supplies will be imported by 2030 [27]. The Commission's response to the Green Paper acknowledged that it 'drew attention to the structural weaknesses and geopolitical, social and environmental shortcomings of the EU's energy supply, notably as regards European commitments in the Kyoto Protocol' [28].

Furthermore, energy systems in the developed world are not democratic. Ownership is generally concentrated and this can be either in terms of state control (usually vertically integrated) or more recently, by the market, where energy is viewed as a commodity. Both approaches tend to be hierarchical. Despite the promise privatization would bring a more horizontal structure and a more democratic shareholding base, the reality has proved different. Thomas evaluated the impact of privatization in the UK and concluded the benefits are illusory and '... there is a serious risk that the electricity industry will become a weakly regulated oligopoly with a veneer of competition' [29].

These inherent problems raise questions about the appropriateness of developed world energy systems as models when considering technology transfer to those parts of the world that do not, as yet, have fully developed systems. Technology transfer (for example, the Clean Development Mechanism, CDM, of the Kyoto Protocol) should ensure the poor will have access to affordable energy services as a pre-condition of the transfer. Another condition should be that the recipient country has sustainable approaches. But this is not apparent. A recent Organization for Economic Cooperation and Development (OECD) survey summarized the emerging trend:

> 'a large and rapidly growing portion of the CDM project portfolio has few direct environmental, economic or social effects other than GHG mitigation, and produces few outputs other than emissions credit' [30].

The CDM is simply shifting the location of where the greenhouse gas (GHG) emission reductions are generated and is failing to make a contribution to the sustainable development of the host.

Intervention driven or market led?

Scenarios are a powerful tool to determine outcomes. There are two broad classes of scenario. Explorative or descriptive scenarios typically explore the outcome of decision-making. Normative or strategic scenarios start with a desired outcome and work backwards or 'backcast' to establish the conditions needed to realize the outcome. Peter Schwarz emphasises that the end result of a scenario is not an accurate picture of tomorrow but better decisions about the future [31].

As part of its commitment the EU has set targets for greenhouse gas reductions and has been promoting renewables for a number of years. The most successful approaches are seen where member states have laws requiring utilities to purchase electrical power from renewable sources such as in Germany and Denmark, as opposed to target setting in countries including the UK. Where direct market intervention has occurred, public response has been impressive. This action, with awareness campaigns, has seen the emergence of a growing sector that can be characterized as the customer-generator. An individual household or organization can install renewable capacity and sell during times of excess production or buy in times of shortfall. The key has been ensuring the purchase price of renewable power is sufficiently attractive to interest the household level.

Mez notes that despite opposition from the nuclear and coal industries, public opinion in Germany has supported alternative approaches and the schemes implemented have placed Germany second to Denmark in terms of the wind power industry and second to Japan in terms of the Photovoltaic (PV) industry [32].

In Denmark, a combination of legislation and support for renewable energy has produced rapid growth in the sector, particularly in wind power. An essential feature of the Danish wind sector is the high level of public support (approximately 80% of the population) and the cooperative ownership of many installations. Around 150,000 Danish households were registered as owners of shares in wind turbines during 2001 [33]. In addition, Denmark has established the Samso and Aero Islands projects where all energy requirements will be supplied from renewable sources. The project was initiated in 1998 and plans to be fully operational by 2008 [34].

One notable characteristic of renewable energy development in Denmark and Germany is both the variety of technologies, in particular wind, solar, PV and biomass and the scale, from roof-mounted and building-integrated installations to large scale on- and off-shore wind farms.

Two strategies for the introduction of renewable energy technologies are beginning to emerge. One concerns large-scale developments, for example, both off- and onshore wind farms, echoing the scale of hydrocarbon-driven capacity. The other is smaller, local, and has the potential to be stand-alone but is grid-connected enabling power to be imported and exported. Ownership can be individual, cooperative, public or private or a combination of both and the scale can be household or local, municipal or regional. In short, developments are more diverse in type, based on indigenous resources, situated close to the point of use and have a management and ownership structure reflecting the communities they serve. This demonstrates the steps needed to develop sustainable energy systems, with the key element being the empowerment of citizens as integral to the decision-making process in the choice of

system [35]. Intervention is needed to establish desired outcomes. Uses of market-based instruments such as the CDM, despite worthy intentions, are more likely to serve the needs of the developed world. Should the developed world be allowed to put off the need to reduce its energy consumption by use of such mechanisms, or should international efforts to reach the MDGs be conducted?

Addressing the obstacles

There are formidable obstacles to wide-scale deployment of clean and sustainable technologies. Many large energy companies see distributed small-scale generation as a threat [22]. The conventional energy sector receives some US$200 billion in subsidies ensuring it is difficult for emerging technologies such as renewables to compete. These subsidies coupled with a range of institutional and policy barriers are inhibiting development of the renewable energy sector [36]. The International Renewable Energy Conference in 2004 concluded that removing subsidies and internalizing external costs would be necessary to establish a level playing field. Internalizing external costs (externalities) would involve taking account of the environment and health costs as a result of the production and consumption of energy-related activities. One method of internalizing externalities would be an eco-tax whereby damaging fuels and technologies would be taxed according to the external costs caused. If the external cost of producing electricity from coal, for example, were to be factored into electricity bills, two to seven eurocents per kWh would have to be added to the current price of electricity in the majority of EU member states. Alternatively, external-cost estimates in cost–benefit analysis could be used. In such analysis the costs to establish measures to reduce a certain environmental burden are compared with the benefits. Another solution would be to subsidise cleaner technologies, therefore avoiding socio-environmental costs [37]. The European Community guidelines on state aid for environmental protection foresee that EU member states may grant operating aid, calculated on the basis of the external costs avoided, to new plants producing renewable energy [38].

Despite the obstacles, the cost of renewable technologies are falling and global investment in renewable energy set a new record of US$30 billion in 2004. Grid-connected Solar PV outstripped all other energy technologies in the world, by growing in existing capacity by 60% per year from 2000 to 2004. In second place is wind power capacity, which grew by 28% in 2004 [39]. According to Christopher Flavin,

> (These dynamic growth rates are driving down costs and increasing political strength of the new industries, which is in turn driving further growth ... A decade from now, renewable energy is likely to be an accepted part of the mainstream energy business – and in a position to dominate the market for new electricity generators.) [40]

On-shore wind costs are now half those of 1990 levels and further reductions are set with site optimization, improved blade/generator design, and electronics. Solar PV module costs have declined by 20% for each doubling of installed capacity, or by approximately 5% per year. Costs rose during 2004 due to market factors, however, further declines are likely with advances in materials, design, process, efficiency and scale. Additionally, rooftop solar PV costs are continually declining due to lower solar PV module costs and improvements in inverters and balance-of-system components [41].

Many economists argue, however, that finding an alternative to coal and oil will prove difficult and expensive and believe we should delay the transition for as long as possible. Furthermore, under 'business as usual' scenarios both the US Energy Information Administration (EIA) and the International Energy Agency predict that while renewable energy use will continue to grow over the coming decades, the global share of renewable energy will actually decline between now and 2030. In contrast, if worldwide political support for renewables continues to rise in response to: rising demand for energy; increasing concerns regarding fuel supplies and global security; growing threats of climate change and other environmental crises; and if there are significant advances in renewable energy and understanding of the benefits they offer, the share of renewables will increase significantly [41]. Evidently, current growth rates coupled with economies of scale, additional private investments in research and development (R&D) and manufacturing capability will see competitive, cost-effective renewable technologies.

Facing the energy poverty issue

Despite technological transfer, some 1.4 billion people will be without grid connection by 2030 [42]. Finding an approach that would deliver energy to those excluded from the grid would make contributions both to the MDGs and the climate change mitigation debate. Achieving significant reductions in greenhouse gas emissions is a major challenge. This will prove difficult for many OECD and industrializing nations. Greenhouse gas emissions will increase by 50% unless energy consumption is reduced [43]. Alternative pathways are under development; but a comprehensive approach would exercise the technology and develop capacity in transferring it to the beneficiary. This process would enhance local capacity and governance whilst taking a step towards breaking the energy poverty cycle.

Markets respond to signals. The development and deployment of technology can be a combination of signals and developments with an outcome difficult to predict. Industry often misses these signals, and some developments have been termed disruptive [44,45]. A disruptive technology or innovation is a technology, product, or service that overtakes an existing dominant technology in the market. The innovation is often both radically different from the leading technology and initially, it often performs worse than the leading technology, according to existing measures of performance. There are numerous examples, from the steam and internal combustion engines replacing the horse through to digital photography replacing chemical photography. In the energy sector the emergence of small-scale renewable technologies offers the scope for a new approach to energy production and management. For those areas unlikely to be grid connected, small-scale, distributed and stand-alone systems as an intervention in the sustainable development policy nexus can unite many aims of the international community. They can promote resilient communities and reduce climate change risk to vulnerable populations [16]. Small-scale renewable technologies house the potential to act as disruptive innovations and have the capability to interrupt the energy poverty cycle.

The Conference of Parties (COP) has a mechanism in place through the CDM for promoting small-scale renewable energy and efficiency projects. But as Brunt *et al.* show, despite changes to reduce costs and approval time there remain considerable barriers to a greater take-up of small-scale projects, particularly in rural areas where many are excluded from the grid [25]. One possibility would be to assign a greater value to the carbon emission reductions (CERs) generated by such projects. Similar actions were adopted by the World Bank Community Development Carbon Fund (CDCF) that places a 15–20% premium on carbon [46].

Alternative ideas are based upon adopting a sectoral approach with the CDM. Helme argues this would promote a bottom-up approach that would be founded upon technological feasibility and cost-effectiveness as well as proving administratively and politically easier [47]. There is some merit in a more focused approach. This suggestion, however, is limited in terms of the energy poverty debate as it centres on existing industrial and commercial sectors. This is not the same as focusing on energy poverty!

To break the energy poverty cycle requires greater incentives for development efforts and a greater focus on the most marginalised and vulnerable groups, particularly as it is likely that without direct interventions they will remain at the bottom of the energy ladder. This coupled with longer-term climate change risks to their energy livelihoods such as changing forestry patterns will increase vulnerabilities. Three actions are needed. First, those excluded from the grid, the most vulnerable communities, should be declared a sector. This will enable these communities to receive greater attention and allow special measures to be introduced to speed up approval processes for projects. Additionally, this sector could receive further special treatment in terms of registration fees and other transaction costs. Second, CERs should be awarded a premium weight. The ascent of the energy ladder to a height of sustainability and resilience would avoid considerable carbon emissions. This avoidance, along with the contribution made to sustainable development, would provide considerable flexibility in determining at what level the carbon credit should be set to attract sufficient interest. Third, a source of finance for local communities to aid project development is needed. Experience shows where access to low cost credit is unavailable there is a strong possibility that longer-term development of the project will be jeopardized. Establishing a micro-credit financing scheme for sustainable energy systems could either be undertaken or underwritten by the COP.

This may be difficult, but to leave the poor without power militates against international commitments set out in the MDGs. The private sector is unlikely to act, without indication from the international community that it regards the alleviation of energy poverty as a priority. With the right signals and incentives emanating from COP, however, it is likely that developing sustainable and resilient energy systems for the powerless will provide valuable experience in adapting the developed world also in the same general direction.

Learning the lessons?

Three lessons emerge. First, the energy problem cannot be solved without solving the poverty problem and the poverty problem cannot be solved without solving the energy problem. Second, top-down approaches have not delivered beneficial results in the developed countries. The recent failure by the UK to meet its own target for a 20% reduction in carbon dioxide emission reductions shows that simply moving to a lower carbon content fuel is insufficient. Sustainable solutions to the energy issue require that both the demand and supply side of the energy system need to be addressed. This requires market interventions and a signal of intent by government. Third, the importance of international agreements cannot be exaggerated. But agreements that do not include all nations and fail to promote an equitable and just approach are more likely to lead to efforts that are aimed at self-interest as opposed to the common cause. Kyoto is a useful start, but in the longer term Contraction and Convergence is more likely to lead to a sustainable and just solution.

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Appendix 6

Future UK Emergency Management: New Wine, Old Skin?
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O'Brien, G. Read, P. (2005)

Future UK emergency management: new wine, old skin?

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Abstract

Purpose – The purpose of this paper is to review the changes made to civil protection in the UK, both legislative and capacity building, that aim to make the UK more resilient.

Design/methodology/approach – Reviews the background to changes in UK civil protection and compares these with the work being done by the broader disaster management community on the meaning and development of resilience to a range of threats.

Findings – Finds that the UK approach has been deflected by the terrorist attack of 11 September 2001 and is clearly focused on organisational resilience. This top-down approach does not augur well in terms of promoting a more resilient society. The paper also questions if it is time to take a broader view of what constitutes an emergency.

Originality/value – The recent changes in UK civil protection are in many ways welcome. But the promotion of more resilient communities requires a bottom-up as opposed to a top-down approach. Government funding is aimed mainly at institutional resilience. This raises the question of how to promote a broader agenda of more resilient societies able to respond to a broad range of threats.

Keywords Emergency measures, Disaster management, Terrorism, Sustainable development, United Kingdom

Paper type Viewpoint

Introduction

In the UK, the aftermath of the Second World War had a major influence in the evolution of emergency management. Growing fears of a possible attack by a former ally led to the Civil Defence Act, 1948. This set out procedures for the public to protect themselves in the event of a nuclear attack. At the local level, the UK central government was quite willing to let local agencies deal with emergencies. Although local organisations were able to draw on regional and national resources through a designated lead government department, the planning and execution of emergency activities was left to local organisations. Central government did not feel it necessary to place a duty on them to co-operate and co-ordinate local efforts. Against this background emergency management in the UK developed in a complex way with the responsibility to plan for and deal with emergencies being very much a local function.

This approach of central and local responsibilities remained the hallmark of UK emergency management up to the 1980s (Hills, 1994). The Civil Defence in Peacetime Act of 1986 recognised the end of the cold war era and effectively legislated for the system already in place. In the late 1980s, a number of civilian disasters (Kings Cross, 1987, Zeebrugge, 1987, Clapham rail crash, 1988, Hillsborough, 1989) pushed a review of emergency planning procedures up the political agenda. However, the reviews of 1989 and 1991 concluded that there was no need to reform the current structure of emergency planning and response in the UK. The system, with appropriate lead government departments acting as co-ordinators with local services preparing plans

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and undertaking operations on the ground, remained in place up to the end of the last millennium (Smith, 2003).

However, the Millennium Bug experience demonstrated to government that it could not direct at local level, with many government departments feeling constrained because they lacked formal powers to require information or action (Beckett, 2000). This was further reinforced by the flood events in the autumn of 2000 and described by the Deputy Prime Minister as a wake up call for UK emergency management (HC, 2000). The UK Fuel Blockade crisis of September 2000 added weight to this call and to the recognition that wholesale reform was needed. By February 2001, the process of review, initiated by the Home Office had begun. By July 2001, the lead responsibility had been transferred to the new Civil Contingencies Secretariat within the Cabinet Office and government launched a consultation exercise on the review, requesting responses by the end of October 2001. The review of course was much broader than responses at the local level and was intended to establish a national, regional and local framework for anticipating and responding to a range of threats. As Alexander (2002a) observes it is in the aftermath of disasters when political support for change is likely to be the strongest.

The events of September 11 introduced an added dimension to and accelerated this process. Although the UK has had extensive experience in dealing with traditional terrorist threats, September 11 introduced a form and severity of terrorism not previously encountered in the UK – a dimension where the terrorist has no concern for their own life and is intent on causing as many fatalities as possible. There had been precursors to September 11 in other parts of the world, for example the Sarin attacks in Tokyo. However, September 11 raised fears that terrorism of a new kind, organised, well financed and planned, ruthless and determined, was about to be unleashed.

Resilience

During 2004 the intentions of the UK government became clearer. It has mapped out and implemented a legislative and capacity building programme under the banner of UK Resilience (UK Resilience, 2005). Resilience is a term increasingly used in reference to both civil society and the emergency services and is defined by the Civil Contingencies Secretariat, that is leading the reforms in the UK, as:

> The ability at every level to detect, prevent, prepare for and if necessary handle and recover from disruptive challenges (Great Britain. Cabinet Office Civil Contingencies Secretariat, 2004, p. 1).

The use of the term resilience is an interesting choice by the UK government. Resilience as a concept was initially used in ecology to describe the ability of ecosystems to resist and recover from external negative impacts (Blaikie and Brookfield, 1985). The term is increasingly used in the disaster management sphere and reflects a trend towards a holistic and proactive approach that has the community, and its ability to resist and recover, as its focus. The term resilience brings together the components of the disaster cycle – response, recovery, mitigation and preparedness, utilising a range of structural and non-structural approaches. There are a number of definitions of resilience. Burby *et al.* (2000) and Mileti (1999) state that resilience applies to the minimisation of losses and damages when a disaster occurs and Emergency Management Australia defines resiliency as "A measure of how quickly a system recovers from failures" (quoted in

Buckle *et al.*, 2000, p. 9). In both these definitions it is clear that a holistic approach to disaster prevention is advocated. Minimising losses and damages and recovering quickly both imply some level of community preparedness and an anticipatory viewpoint. Resilience is increasingly used in the growing global debates on the need to reduce the impacts of disasters. The United Nations International Strategy for Disaster Reduction (UN/ISDR) has adopted the term resilience and defines it with reference to natural hazards as:

> The capacity of a system, community or society to resist or to change in order that it may obtain an acceptable level in functioning and structure. This is determined by the degree to which the social system is capable of organizing itself and the ability to increase its capacity for learning and adaptation, including the capacity to recover from a disaster (UN/ISDR, 2002a, p. 24).

Risk to human populations is a function of frequency (occurrence of a hazard), severity and vulnerability. Vulnerability represents a range of factors that express the state of development that determine the amount of damage and loss of human life that a particular hazard can cause. McEntire (2001) cite a number of factors that are increasing vulnerability and are related to the physical, social, cultural, economic, political and technological developments of society. Vulnerability and resilience are tied together with the ways in which societies develop. Disasters result from a complex mix of conditions.

Mileti (1999) suggests that there is close relation between resilience and sustainable development. Tobin (1999) takes this further by arguing that the interconnectedness of many issues at different spatial scales, including globalisation, impacts the resilience of local communities and defines sustainable and resilient societies as those structurally organised to minimise disaster impacts and able to recover quickly by restoring socio-economic vitality.

It is clear from the research by the international community on the relationship between hazard, risk, vulnerability and development (UN/ISDR, 2002a, b; UNDP, 2004) that there is a clear relationship between disaster and development and sees effective disaster management as an integral component of sustainable development. This is reflected in the call by WSSD (2002) for disaster reduction strategies that have a twofold aim of enabling societies to be resilient to hazards while ensuring that development efforts do not increase vulnerability to hazards. This call, to enhance resilience at all levels, has been further strengthened by the World Conference on Disaster Reduction held in Kobe (UN/ISDR, 2005).

Development trajectories will continue to produce new hazards that will present new problems for governments in that they will find it difficult, if not impossible to regulate through a legislative framework. Globalisation has both its critics and advocates (it is beyond the scope of this paper to argue the merits or otherwise of globalisation), but it does present new vulnerabilities. For example the frequency and coverage of air travel can help to propagate dangerous diseases as seen with the spread of the SARS virus. Other areas are the global dominance of one information communication technology (ICT) operating system making it a target for hacker attacks and a vehicle for spam e-mails. This has had significant consequence for the European economy with the European Commission reporting half of e-mail traffic is spam resulting in losses of $3 billion in productivity in 2003 (BBC, 2003). This is just the tip of the global iceberg in terms of increased vulnerabilities resulting from

globalisation. This is less a criticism of globalisation but a recognition that it can have unintended consequences.

Resilience is a holistic approach to disaster management that encompasses the components of the disaster management cycle. Resilience requires that the capacity of governance structures, civil society, communities and individuals to both mitigate and adapt and adjust to both current and future hazards and threats must be promoted and developed.

UK approach to resilience

The UK government has made significant structural changes to civil protection, bringing the legislative framework up to date, introducing new duties and codifying what already happens in practice. The Civil Contingencies Secretariat, based in the Cabinet Office, provides a focal point.

The changes to the legislative base underpinning civil protection are wholesale. The Civil Contingencies Act, 2004 (HMSO, 2004) clears outdated legislation, re-defines emergencies, clearly identifies the roles and responsibilities of all participatory organisations, introduces a mandatory regime for responders and replaces the previous outdated system for emergency powers. The Capabilities Programme (UK Resilience, 2003), now underway, has been developed to ensure that there is capacity to respond effectively and efficiently to the potential effects of massive disruptive events.

How effective is this new regime likely to be in improving resilience? There is little doubt that this is a very comprehensive approach. Clear organisational structures making the process transparent, multi-agency approaches that bring together a range of expertise needed to face increasingly complex challenges, a clear audit of capabilities to fill gaps in provision and a duty throughout the UK on local responders leading to a uniform and consistent approach. However, there are areas in the reform process that raise questions about whether or not the UK government has taken a holistic approach to resilience or whether it has focused on particular areas, thereby undermining the concept of resilience.

Local level and civil contingencies act

At the local level many of the changes simply codify much that was already happening. Sections 2-4 of the Act set out new duties for local responders to undertake risk assessments, develop Community risk registers and promote organisational continuity. A new regional tier has been introduced that provides a platform for a regional role in both planning and response in relation to civil contingencies (ODPM, 2003). The regional tier will provide improved co-ordination and facilitation but the actual delivery of a response to a disruptive event will remain, for the most part, with local responders. The regional tier compounds the problem of boundary mismatch – a feature of UK emergency responders where the "Blue Light " services (Police, Fire and Ambulance) work to different map bases that, in turn, are different from local authorities.

Will local services fall under regional direction or will the status quo remain? What is clear is that the spatial mismatch of boundaries between different responders will remain a feature of UK civil protection.

Many of the reforms proposed at the local level are long overdue. However, many local response organisations function effectively and have already embraced much of

the proposed reform. For example, a changing approach to risk and greater community involvement (the Fire Brigade for example has been proactive in promoting prevention and has an established network of community fire stations), the imposition of a duty should promote greater uniformity of approach. The challenge will be in ensuring that capacity is uniformly developed and the reforms offer little evidence of how this will be achieved.

One of the key changes is the approach to risk. Anecdotally evidence suggests that although risk (and consequently risk prioritisation) has been based upon experience and expertise of practitioners without qualitative audit, the new duties require a written justification of the prioritisation process. Section 2 [1] [f] of the Act requires the development of a Community Risk Register, which will be available for public scrutiny. This is a step change in approach reflecting government concern. The cleavage between government and governed about the reliability and truthfulness of "official" information and "expert" opinion and the reluctance of the citizen to accept this at face value is well established. As the Strategy Unit (Great Britain. Cabinet Office, Strategy Unit, 2002) of the Cabinet Office states for government effectively to discharge its responsibility in communicating risks, it needs to have a track record of openness and reliability. It cites the Bovine Spongiform Encephalopathy (BSE) outbreak and the Measles, Mumps and Rubella (MMR) vaccine as examples of particularly difficult risk communications to the public. Government recognises this and sees the involvement of the public in prioritising risks as crucial to the validity and acceptability of the process. Communications is of paramount importance. How effective this two-way communication will be and how well it will act as a vehicle for strengthening resilience is difficult to judge as the media, particularly the newspapers, tend to sensationalise. Perceptions indicate that public distrust is deep and both government and the local response agencies will have to work hard if they are to convince the public.

The introduction of a duty to promote continuity management in section 4 of the Act is necessary, as experience in the UK has shown that many organisations fail to recover after a major incident. The Home Office (Great Britain. Home Office, 1999, p. 15) in their publication *Business as Usual* state that research has shown that 80 per cent of small businesses without business recovery plans fail within one year of a major disruption. It is understood that this research looked at the aftermath of terrorist attacks on the economic infrastructure in the UK with especial reference to the bomb that devastated the centre of Manchester in 1996. This is further supported by research by The London Chamber of Commerce and Industry. Its publication, *Disaster Recovery, Business Tips for Survival* (London Chamber of Commerce and Industry, 2003), points out that many UK businesses do not have plans for recovery after an incident and in the event of a data failure 90 per cent would go out of business.

Capabilities Programme

The Capabilities Programme is split in to three discrete areas; structural, functional and essential services. It is clear from the programme focus (chemical, biological, radiological and nuclear (CBRN) terrorism, mass evacuations, mass casualties and fatalities, site clearance and infectious diseases), that the rationale is based primarily on the threat of a terrorist attack. Although the UK has had extensive experience in dealing with "conventional" terrorist attacks, these have usually had an economic

focus. It can be argued that the emphasis of the capabilities programme is on the kind of terrorism that is designed to maximise casualties and fatalities rather than economic damage. In this sense, the Capabilities Programme is very much a response to the events of September 11, 2001. The command structure is based on a single chain of command that is able to appropriate resources as and when required. This is a very different approach to the local structure, where agencies have to co-operate and collaborate. There are dangers associated with this. Local efforts have been built on collaboration. Central efforts tend to a command and control model. There is a danger, as Alexander (2002b) points out, that the ethos of civil protection could be undermined by centralism. This mix is dangerous with command and control likely to dominate particularly in times of crisis.

Commentary

UK civil protection has undergone massive changes, and will continue to, driven by events in the wider world. The reforms at the local level are certainly welcome, as they will help to promote uniformity and foster closer relations between response agencies. However, the overall structure of civil protection will remain largely the same; that is, government fulfilling the role of co-ordinator and offering guidance and with local agencies left to get on with the task.

Will this promote a more resilient UK? Data do show that the frequency of natural disasters is increasing in Europe and the UK (Munich Re, 2003). Much of this has been attributed to climate change and the threat it brings of more unpredictable weather patterns, rising sea levels, new disease vectors, disturbance to agricultural systems and the impact of higher temperatures on the vulnerable in society. Climate change has been described by the UK chief scientist, Sir David King (King, 2004), as a greater threat than terrorism. There are many more threats, in addition to those cited earlier, such as genetically modified organisms, drugs, social dislocation, changing demographics, extremist movements, novel technologies, to mention a few, that in the longer term may undermine society.

Civil protection by its nature is an area that can easily be neglected. In the UK, local government emergency planning has often been the Cinderella of local services. It is something never needed until it is required. The amount of funding for emergency planning fell from £29 million in 1988-1989 to just over £14 million in 1997-1998 (Coles, 1998). There were also wide variations in the amount of additional funding provided by local authorities (LGA, 2003). The lessons to be learned are that emergency planning has fallen foul of other local political priorities and even with a clear duty, will take some time for an even and consistent fiscal approach to develop across the UK. Funding at the local level has recently been increased. The *Spending Review* (Great Britain. HM Treasury, 2004) doubled the amount of civil defence grant from £19 million to £38 million. It also announced its intention to transfer the ring-fenced grant into the mainstream Revenue Support Grant (RSG) once the duties under the Civil Contingencies Act are in place. This raises concerns that this could be used to fund other local political priorities. The increase is welcome but it is dwarfed by the central government spending on promoting capability to counter terrorism. The *Spending Review* also provided additional resources of £450 million in 2006-2007 and £560 million in 2007-2008 to enable departments to strengthen the UK's Counter Terrorism and Resilience capabilities. By 2007-2008 the UK's planned investment in this area will

be over £2 billion, more than double the pre-September 11 2001 level. Spending is a clear indicator of government priorities.

There is little evidence of attempts by government to promote the wider resilience agenda at the local level beyond that already undertaken by response organisations. The government has distributed to each UK household a pamphlet describing actions for individuals and families in the event of an emergency (UK Government, 2004) but nothing further is proposed to promote wider resilience. Evidence shows that public awareness campaigns of this kind do little to improve preparedness at the individual and local level (Ballantyne *et al.*, 2000). Developing and enhancing community resilience requires the active involvement of the emergency services in assimilating and co-ordinating the perspectives and needs derived from community consultation and providing the information and resources to sustain empowerment, self-help and resilience (Paton and Johnson, 2001).

So what is the future of UK civil protection?

Much of the UK government proposals for civil protection should lead to improvement. However at the local level funding is likely to continue to be a contentious issue where Local authority funding is itself a cause for concern. There is a need for clearly identified, adequate resourcing to deliver UK resilience. At the national level, there is too great an emphasis on centralism. The focus of the UK resilience is very much about institutional resilience as opposed to a holistic approach. In reality, the promotion of resilience stops at the level of local responders and no meaningful effort is being to promote the wider resilience agenda. This, in the longer term, could be problematic.

Resilience in the face of international terrorism is an obvious current priority in the UK, but wider considerations should not be subsumed by this single source of threat. UK resilience is a worthy ideal yet, unless it is woven through the policy fabric of government, it is likely to be no more than a panacea unless it includes the wider agenda of vulnerabilities and includes a focused effort in engaging the wider public in strengthening community resilience. The UK government is using a variety of high profile exercises to demonstrate its commitment, for example the London Underground evacuation exercise of September 2003, but there is a danger that these could be no more than propaganda events as opposed to a real attempt to improve resilience.

McEntire *et al.* (2003) argue that we need a new paradigm for civil protection. They cite a range of approaches, each with merit, and conclude by arguing that a comprehensive approach to emergency management is needed. Given the complexity of the hazards we are likely to face, driven by anthropogenic activities that are, and will continue, leading to a series of unintended consequences, then arguably civil protection should engage on a wider front. Perhaps we should no longer think of civil protection as being bound by the narrow definitions of what are considered emergencies and look to promote a broader agenda based on the range of problems faced by civil society.

The reality is that emergency management at the local level will probably continue to be inadequately resourced and therefore unable to provide a service compatible with changing public expectations. Experience and expertise of emergency management at the local level will continue to develop over time as new threats emerge. The new duties mean that there is likely to be a more uniform and qualitatively audited approach. Nationally, the future structure of emergency management provision is much more difficult to predict.

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Appendix 7

UK Emergency Preparedness – A step in the right direction?
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UK EMERGENCY PREPAREDNESS: A STEP IN THE RIGHT DIRECTION?

Geoff O'Brien

In an increasingly dangerous and uncertain world, preparedness, at all levels, for a range of threats is a key aspect of effective emergency management and of public reassurance. Preparedness is a combination of structural and non-structural measures designed to reduce known risks but also to ensure effective responses to a range of threats. At the beginning of the millennium a series of events exposed the fragmented approach to UK emergency management and triggered a wide-scale review aimed at making the United Kingdom more resilient, that is, more able to withstand and cope with disruptive events. The terrorist attacks of 11 September 2001 in the United States occurred during this review and affected the outcome, leading to an approach more focused on institutional resilience than promoting it at all levels of society. Yet the bombings of 7 July 2005 in London demonstrated that no matter how well prepared, it appears almost impossible to prevent such atrocities, particularly if the terrorists themselves have no interest in surviving the attack.

The end of the 20th century and the beginning of the 21st century saw the world enter a new era in terms of emergency preparedness. Though there are still many instances where the triggering agent for disaster can be predicted, such as the hurricane season, there are many instances when we have little or no warning. Climate change represents only one example of threats for which we have no experience upon which to draw and from which there can be no return to the earlier status quo. Rapid technological change, the increased risk of diseases spreading globally through air travel, the looming energy crisis, changing geopolitical trends and the threat of terrorism with no regard for life represent a new set of challenges for which we have to prepare. Arguably we now have to think creatively; new approaches to civil protection are needed. Ignoring the new realities is perilous and not engaging the wider public in the process of preparing for such possibilities is a denial of responsibility.

Terrorism, repugnant though it is, seems to have transfixed the government in the United Kingdom. There is now a danger that civil protection in Britain and other

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developed countries will simply focus on fortifying against such attacks. Such a focus could lead to the sacrifice of approaches that promote a more resilient society that is able to respond to, and cope with, a range of threats. This article evaluates the changes to civil protection in the United Kingdom. In doing so it identifies a clear institutional focus and posits that such an approach neglects to engage the public in the wider debate surrounding societal responses to the changing landscape of risk.

Managing Risks in an Era of Social and Technological Change

Risk assessment and management involve both institutional preparedness and societal attitudes. Risk assessment underpins emergency preparedness and requires a clear understanding of both internal risks, such as the location and management of hazardous industrial facilities, and external risks, such as terrorism or human-induced climate change. Risk management characterizes systems that both mitigate risk and deal with consequences should an emergency occur. Societal attitudes, however, shape the ways we respond to information, including warnings of possible danger. Increasing skepticism or disbelief in official pronouncements undermines attempts to ensure the public is properly informed.

Profound changes took place during the 20th century that shaped the risk landscape and societal attitudes to risk. The United Kingdom saw great social and technological changes in the latter half of the 20th century. Individualism rose with the information revolution and the emergence of a highly educated and increasingly mobile information society, and was typified by the declaration by Margaret Thatcher that there was "no such thing as society."[1]

The corollary to this was the transfer of loyalties from institutions and structures to individual values or individualism in what Ulrich Beck terms reflexive modernity.[2] Beck, a German sociologist, argues that the Industrial Revolution, the first modernity, saw many radical changes in everyday life, yet it was still based on traditional social structures, particularly family and gender. The latter half of the 20th century, the second modernity, saw further changes, for example women entering the workplace, the shift from full-time to part-time employment, the erosion of lifetime job security in both blue-collar and white-collar occupations and changing family and social structures, which began to modernize the foundations of the first modernity, making it reflexive. This latter part of the 20th century thus became an era that called into question both the role and legitimacy of institutions and structures.

This increasing skepticism of officialdom is illustrated by the BSE (bovine spongiform encephalopathy) epidemic. The first reported case in Britain occurred in 1986 and, despite warnings from the scientific community, the government failed to act or show concern about the possible transfer to humans. Tragically transfer did occur in a new variant form of Creutzfeldt-Jakob disease (CJD), details of which were leaked to the press in 1996. The intervening period between the first case of

BSE and the first case of CJD was punctuated by denials and reassurances by officials and politicians in response to growing public concern, described by Sheila Jasanoff as "civic dislocation."[3] The impact on the public was dramatic and trust in the UK government effectively vanished. Bruna De Marchi and Jerome Ravetz, in their analysis of the problems of risk and governance drawn from a number of case studies, characterize the situation in the following way:

> For the deeper problems of governance, the BSE case is the watershed. Whatever the ambivalences in the governance of risk that were shown at Seveso (and other cases like Chernobyl), it was only with BSE that it became elementary prudence to adopt the motto "Don't believe it until it is [sic] been officially denied."[4]

The resultant skepticism following the BSE crisis does raise a number of concerns for risk and governance. Risk is socially constructed and is inseparable from probability and uncertainty. It is the assessment of hazards and the possibilities that they might present. In an increasingly uncertain and rapidly changing world, nations such as the United Kingdom are vulnerable to distant events, ranging from economic crises on the other side of the world, diseases spread by air travelers and cyber attacks on global networks, to long term changes in the planetary climate system induced by anthropogenic activities. Managing these risks will be more difficult in a skeptical and questioning environment, given that many people are likely to have access to the same information from the media and World Wide Web as the policymakers and can thus develop their own independent risk assessment.

Shared Responsibilities and Evolving Risks

Since industrialization, society has become increasingly concerned with manufactured risks associated with the impact upon the world such as technological developments that lead to the emission of greenhouse gases and their impact on the climate. Yet we have no experience upon which to draw to deal with the consequences.[5] Thus, as society ties to cope with new circumstances in an increasingly skeptical world, the evidence of risk, and an understanding of its consequences, must be clear since risk management, in terms of governance, requires the agreement and coordination of many actors. When consequences are easily understood, for instance the dangers associated with automobiles, rules governing use such as speed restrictions are usually accepted, if not welcomed. In this instance there is a clear relationship between the different actors in the risk management chain, from the legislators enacting rules to the vehicle driver recognizing the reasonableness of the speed restriction. On the other hand, arbitrary or unreasonable rules are often ignored. Where there is uncertainty, distancing an actor in the risk management chain can lessen effectiveness, as in the BSE case, for instance, it led to the suspicion that the truth was not being fully disclosed.[6] This becomes ever more problematic as risks

become globalized and the nation-state finds it has neither the resources nor the legislative and regulatory frameworks to deal with a problem.

As the world becomes increasingly more interconnected and interdependent, nation-states are reaching beyond their borders to find ways of collaborating to reduce risks. In the European Union (EU), this has worked well in instances where the treaties binding member states outline areas, or competencies, where legislation can be introduced to deal with a problem. For example the Seveso Directive regulates hazardous facilities across the EU.[7] Although the EU has successfully regulated hazards, such as transfer of toxic waste between member states and long-range transboundary air pollution, it only has competency to regulate for the environmental impacts of industrial hazards and large-scale project developments. The broader range of risks to civil protection, such as floods, fire, civil transportation accidents and health risks, remains the purview and responsibility of individual member states.

Nation-states are reaching beyond their borders to reduce risks.

The problem becomes more difficult when tackling global problems such as climate change. Climate change, though a natural phenomenon, is being accelerated by anthropogenic activities. Though there is recognition throughout the international community of the threat that climate change poses, arriving at a solution is proving very difficult.[8] Though there has been a proliferation of international agreements or environmental regimes, studies into their effectiveness show that successful regimes, for example the Montreal Protocol, require the engagement of all major global players.[9] Thus, the decision by the United States not to sign the Kyoto Protocol that sets binding targets for emission reductions undermines the global approach to tackling climate change. When risks are difficult to quantify or are far off, either spatially or temporally, or when a major contributor to a problem does not engage, the difficulties of establishing an effective approach to risk reduction are compounded.

The Globalization of Geopolitical Risk Analysis and Response

Risk generation is not confined to technological and social change. Geopolitical changes can have far reaching consequences in terms of the introduction of new risks and long-term implications on emergency preparedness. In 1991, the end of the Cold War saw the triumph of the market economy and liberal democracy but also signaled the beginning of an era where the certainties of the bipolar past were gone and a more complex geopolitical era began to emerge. A study by Charles J. Dick, a Senior Fellow of the Conflict Research Studies Centre, part of the Defence Academy of the United Kingdom, looks at the nature of conflict over the next twenty years. Dick argues that the future is potentially very dangerous for democratic societies, in terms of intra-state conflicts and almost certainly in terms of the emergence of new

forms of terrorism. The driving reasons for these new forms of terrorism are the growing disparities between rich and poor within and between nations, the competition for scarce resources, the increasing spread of technologies and the shrinking of distance. These changes could lead to the emergence of a variety of non-state actors, including religious, cultural and environmental groups, that will develop new forms of terrorism to challenge existing power structures. Dick posits that tackling divergence requires concerted action to address the disparities and inequalities as conventional warfare is not able to defeat terrorism and its very action could provide the inspiration for new terrorist groups.[10]

In a work that elaborates scenarios for global futures, Paul Raskin et al. point out that there are a number of possible futures which depend largely on the interpretation of risks faced and the responses fashioned.[11] Their analysis starts by stating that human society is at a watershed in development, many futures are possible and it is the decisions taken now that will influence the shape of planetary society. The analysis offers three classes of scenarios. In the "Conventional World" scenario it is assumed incremental changes to markets and policy adjustments can cope with social, economic and environmental change. The "Barbarization" scenario assumes that change cannot be managed incrementally, resulting in either "Breakdown" or "Fortress World." "Breakdown" sees crises spiral out of control, institutional collapse and the world descending into anarchy and tyranny. "Fortress World" sees the emergence of authoritarian regimes and the development of protected enclaves. The final scenario, "Great Transitions," envisages the emergence of new values and development paradigms that emphasize quality of life and material sufficiency, human solidarity and global equity, and affinity with nature and environmental sustainability.

A variety of non-state actors will develop new forms of terrorism.

These two extremely thoughtful and thought provoking pieces highlight the close relationship between the materialization of risk and governance. In this relationship, low probability but high consequence disasters are important, not only in terms of fatalities and damage, but also in terms of the punctuations or changes to the social, economic, cultural or political fabric and momentum of society.

Changing Landscapes of Risk: The UK Response

Though the BSE episode signaled to the incoming Labour government in 1997 that emergency preparedness in the United Kingdom was in need of reform, it was neither an election promise for the party nor a high priority. However, events in the period leading up to the new millennium subsequently persuaded the government that wholesale reform was needed.

In the late 1990s, the Millennium, or Y2K, Bug, referring to the computer dat-

ing system that potentially presented a global technological catastrophe at the turn of the millennium, resulted in a panicked scramble to fix all computer software and hardware before the calendar switched to 2000.[12] However, despite the preparation time afforded, the UK government found that the existing legislative framework did not allow it to require organizations beyond its direct control to test equipment in order to check for continued functioning following the date change.[13] To ensure organizations beyond its regulatory reach were compliant and had tested their electronic equipment, the UK government reverted to an intensive publicity campaign to persuade and cajole them.[14]

With the relatively quiet dawning of the millennium, the United Kingdom experienced two more events that acted as catalysts for the reform of the civil protection in the United Kingdom: the autumn floods and the Fuel Blockade. These were followed by the 2001 Foot and Mouth epidemic, demonstrating the importance of consequence management.

The autumn of 2000 was the wettest on record in the United Kingdom in over 270 years. Recurrent heavy rainfall caused prolonged, extensive and, in places, repeated, often, record-setting flooding. Some ten thousand properties were flooded at over seven hundred locations and there was widespread disruption to road and rail services. The total costs were estimated to be in the order of £1 billion. The floods revealed limited preparedness in dealing with the impacts of climate change. Though many local authorities implemented major incident plans during the crisis, there was a lack of coordination with the major utilities and transportation bodies, demonstrating the need for planning to be integrated across jurisdictions and with other bodies. The discretionary role of planning at the local level and lack of funding demonstrated the need for a consistent financial and statutory basis. Additionally the events showed the need to review investment in flood defenses in the United Kingdom to deal with the ongoing and future consequences of climate change.[15]

Recurrent heavy rainfall caused prolonged, record-setting flooding.

The Fuel Blockade of 2000 is an example of a rapidly escalating crisis that caught the UK government by surprise.[16] The crisis was triggered by reports at the beginning of September 2000, soon after a price increase in crude oil, that fuel prices would rise again. Fuel prices were at historic highs in the developed world. On 7 September protesters blockaded the Stanlow fuel refinery; the situation quickly escalated so that by 12 September protesters blockaded six of eight UK refineries resulting in a shutdown of over half of UK gasoline stations because supplies had run out. The protest ended as quickly as it had started. On 14 September most protesters ended their blockades claiming they had effectively made their point, and the first fuel deliveries commenced the following day.[17] On 16 September the government announced that it would set up a task force to determine what lessons could be

learned from the event.[18] As a result of the work of the task force, on 29 September the government announced that it had reached agreement with a range of stakeholders that would review the location and level of fuel stockpiles, distribution arrangements and crisis management systems.[19] The Fuel Blockade demonstrated that the UK fuel infrastructure, a critical resource and system, was vulnerable to disruptive actions.[20]

Following these events, the UK government initiated a review of emergency planning in February of 2001. The review, which was intended to establish a national, regional and local framework for anticipating and responding to a range of threats and reform the outdated civil defense legislation that was predicated on a nuclear attack, was generally welcomed.[21]

Meanwhile, on 20 February 2001 the first case of Foot and Mouth was confirmed. A National Audit Office report found that "by the time the disease had been eradicated in September 2001, more than six million animals had been slaughtered...the direct cost to the public sector has been estimated at over £3 billion and the cost to the private sector is estimated at over £5 billion."[22] One of the main lessons learned from this epidemic was that contingency plans of the government department responsible for managing were insufficient to deal with the scale of the crisis.[23]

The UK fuel infrastructure was vulnerable to disruptions.

By July 2001, the lead responsibility for managing contingency plans had been transferred to the new Civil Contingencies Secretariat (CCS), which was established within the Cabinet Office after the June 2001 general election. Its purpose, based on experience gained on preparedness from the Millennium Bug and lessons learned about consequence management from the fuel crisis as well as the Foot and Mouth epidemic, was to bring together responsibilities that were dispersed across government departments, a legacy of the earlier civil protection regime. The centralized role of the CCS was intended to make government more resilient to disruptive challenges.[24] The timing of this process is important as the September 11th attacks occurred after the initiation of the review and the formation of the CCS, but before its conclusion. The UK government claims that the September 11th attacks did not influence the development process of the CCS or the review, but instead focused the attention of a wide range of players, including government itself, on increasing the resilience of various governmental and social institutions.[25] According to this narrative, it could be seen that the UK government viewed centralized control through the CCS as a means of ensuring that it had its hands firmly gripping the necessary levers to deal with major disruptions.

However, this interpretation is slightly at odds with the account given to the author by member of Parliament (MP) Nick Raynsford who was Minister of State for Local Government and the Regions at the time of the attacks. He recalls being

asked by then-Home Secretary, David Blunkett, MP, shortly after the September 11th attacks to oversee a review of the level of London's preparedness for a similar attack.[26] This led to the establishment of the London Resilience Partnership in May 2002; the initial role of this alliance of key agencies was to create a preparedness plan for London in case of a terrorist attack.[27]

In both cases, the impact of the changes has been far-reaching. The CCS effectively has oversight of civil protection in the United Kingdom. Its aims are: "to ensure that the United Kingdom and its communities remain a safe and secure place to live and work, by effectively identifying and managing the risk of emergencies, and maintaining world-class capabilities to respond to and recover from emergencies."[28] The objectives of the CCS are to identify potential problems, ensure preparedness and effective responses, and build resilience for future crises, both within the United Kingdom and with EU and NATO partners.[29]

The act redefines an emergency as any event that threatens human welfare.

Underpinning the UK approach is a new legislative framework, the Civil Contingencies Act of 2004.[30] The act has two parts. The first part is focused on local arrangements for civil protection, establishing a statutory framework of roles and responsibilities for Category One Responders—the emergency services (police, fire and ambulance), local authorities and health bodies.[31] The second part focuses on emergency powers, establishing a modern framework for the use of special legislative measures that might be necessary to deal with the effects of the most serious emergencies.[32] The act redefines an "emergency" as an event or situation that threatens serious damage to human welfare, the environment or security of the United Kingdom. Prior to the act "emergency" was defined by the 1920 Emergency Powers Act as interference with specified services and resources which will deprive the community of the essentials of life; the Civil Defence Act 1948 in turn defined it as a hostile attack. However, the 1986 Civil Defence in Peacetime Act reflected a shift in the meaning of "emergency" to mean crises arising from both natural disasters and civil emergencies.[33]

The Treasury Spending Review of 2004 doubled the pre-September 11th spending on civil protection to £2 billion by fiscal year 2007-08.[34] The bulk of the additional spending was earmarked for intelligence and counterterrorism, including some £562 million additional spending in 2007-08.[35] There are, however, a number of changes that reflect the focus of the UK government on making institutional capacity resilient to external non-conventional threats, such as terrorism, that are worthy of further discussion.

Centralizing and Strengthening the UK System

Although prior to September 11th the UK Home Office had published advice

for businesses on ensuring continuity after terrorist attacks, it is clear that lessons about continuity with regards to businesses learned from the attacks have influenced the United Kingdom's approach.[36] The Civil Contingencies Act now requires that UK emergency services have continuity plans that apply to all of their functions, not just emergency response functions. Additionally, local authorities are required to provide Business Continuity Management (BCM) advice to businesses and voluntary organizations. This is an interesting departure from previous practice as it suggests that this new duty for local authorities is meant to cover not only responses to disruptions such as a power failure or fire, but also responses relevant to the new realities of terrorist attacks.[37] These policies clearly reinforce institutional and organizational response at the local level.

It is, however, the changes at regional and national levels that are the most significant. While Part 1 of the Civil Contingencies Act strengthens the local level, Part 2 effectively provides a clean sweep. It repeals legislation covering civil protection emanating from 1948 and the 1920 Emergency Powers Act, deemed inadequate to meet modern threats such as chemical, biological, radiological and nuclear (CBRN) terrorist attacks.[38] The Civil Contingencies Act allows the use of emergency powers either nationally or on the basis of the English regions and devolved administrations of Scotland, Wales and Northern Ireland and requires the appointment of a Regional Nominated Coordinator who will act as the focal point if the emergency powers are used. The scope of the emergency powers set out in section 22 of the Act is fairly broad and includes the use of military forces, the confiscation of property and the prohibition of movement or forced movement in the event of an emergency. What is clear from the guidance to the Civil Contingencies is that emergency regulations made under the Act cannot include the full range of powers set out in section 22 and are open to parliamentary scrutiny and challenge.[39]

The Civil Contingencies Act establishes Regional Resilience Forums (RRF) staffed by officials that provide a single line of communication and information sharing from the local level through to the CCS at the center. Though this is supposed to foster co-operation, the author has concerns about lack of accountability and the possibility of subversion into a command-and-control structure.[40] Militarization during a crisis is a disturbing, but not unrealistic, prospect, and was seen with refugees being herded into the Superdome by armed national guardsmen during Hurricane Katrina.[41] Whether or not we will see the return to a more authoritarian approach as a result of the July 7th attacks in London is not clear, but it is a real concern that the changes toward more civilian approaches following the end of the Cold War might be abandoned in times of crisis.[42]

Though the reforms are claimed to improve UK resilience, the Capabilities Programme, described as the "core framework through which the Government is seeking to build resilience across all parts of the United Kingdom," indicates the gov-

ernment's real priorities.[43] While resilience should be a holistic approach, as further elaborated below, the government's tendency is to narrowly focus on institutional reliance. The program is wide ranging and includes seventeen "workstreams" that fall into three groups:

- Three that are essentially structural, dealing respectively with the central (national), regional and local response capabilities;
- Five that are concerned with the maintenance of essential services (food, water, fuel and transport, health and financial services);
- Nine functional workstreams, dealing respectively with the assessment of risks and consequences; CBRN resilience; human infectious diseases; infectious diseases of plants and animals; mass casualties; mass fatalities; mass evacuation; site clearance; and warning and informing the public.[44]

Though each workstream is the responsibility of a lead government department, the CCS sits at the center and effectively exercises hegemony—a centralized approach with command-and-control overtones. There is also considerable resonance between the nine functional workstreams and the modalities of a terrorist threat, either a suicide bomb attack or CBRN terrorism. Mass casualties, fatalities and evacuations are the modalities of response to terrorist attacks and the capacity for site clearance part of the longer-term recovery and return to normality. There is little doubt that the UK government is focused on terrorism.

Paradigms of Resilience

The sustainability debate linked development and environmental degradation, but newer work has further articulated the relationship between disasters and the ways we develop.[45] The convergence of international agendas for sustainable development and disaster reduction and the link to the Millennium Development Goals (MDGs) is now increasingly recognized throughout the international community and is clearly articulated in the Hyogo Declaration of the United Nations International Strategy for Disaster Reduction (UN/ISDR) 2005 World Conference: "We recognize the intrinsic relationship between disaster reduction, sustainable development and poverty eradication, among others."[46] The declaration identifies pre-disaster planning and a culture of prevention and resilience as key components for risk reduction at all levels along with knowledge of societal vulnerabilities as the starting points for actions. Actions are framed around governance, risk identification and reduction and preparedness.[47] This global declaration, relevant to all nations, recognizes the equal importance of both bottom-up and top-down approaches.

The term resilience has increasingly entered the disaster management debate and is seen through a number of theoretical perspectives.[48] Broadly there are two schools

of thought or definitions of disaster resilience in the disaster reduction debate. The first is an outcome-oriented approach and the second is a process-oriented one.[49] The outcome-oriented school of thought, which is the dominant paradigm in emergency management, can be broadly viewed as coping with or withstanding and returning to normal after a shock. This perspective, which is the dominant paradigm in emergency management, implies that there is some minimum standard for societies in terms of their ability to cope. It is essentially a top-down or command-and-control approach.

There is considerable literature on this approach and from this a number of characteristics of emergency can be determined.[50] Major emergencies are usually considered isolated, one-time events, as distinct from routine emergencies such as traffic accidents, and the risks are perceived as not being normal.[51] Risk management systems such as flood warning systems usually involve technology to detect unusual events or sophisticated heat detection systems for finding survivors in the event of a building collapse. For hazardous facilities, there are legal frameworks underpinning management and operating procedures, such as the Seveso Directive. The emergency management system is usually centralized through a government agency, for example Federal Emergency Management Agency (FEMA) in the United States, or directly in government, for example the CCS in the UK Cabinet Office. After an emergency response, lessons learned from the event that can be incorporated into future responses become part of the post-planning activities. The objective of the emergency management cycle is to restore the status quo. For example, after the floods in the United Kingdom in 2000, damaged homes were refurbished despite the fact that these areas are likely to flood again.

There is an intrinsic relationship between disaster reduction and sustainable development.

One further characteristic of emergency management is opacity. The approach outlined above is mechanistic and can at times distance or confuse the public. During the 2000 floods in the United Kingdom, for example, the public was confused about which organization had responsibility for different sources of flooding such as surface water sewers, streams and major rivers.[52] More recently exercises that have been conducted by the emergency services to test response to various threats have been closed to the public. Exercise Magpie, which was conducted in Newcastle upon Tyne, for example, tested the response of the health bodies to a chemical attack on a municipal building. Though there was a media briefing after the event, the impression that was given was that such events are closed and are the domain of emergency professionals.[53] Patrick Lagadec, in an article discussing new approaches to crisis management in the 21st century argues that civil society should be put back in the loop.[54] Lagadec suggests that the militaristic approach that sees control as a means of preventing panic and looting is not the model we should adopt, particu-

larly when dealing with unique or unusual events.[55] He uses the example of the 1988 Quebec ice storms to show that the public behaves in rational and responsible ways provided they are given the correct information and are seen as part of the process. Research by Enrico Quarantelli shows that though some officials may fear that the public might panic, this is often not the case and people do behave rationally in stressful situations.[56] From this conclusion it is argued that opacity clouds accountability and distancing the public can act in a retrograde way. The opacity of the dominant paradigm tends to lead to low accountability.

The second viewpoint sees resilience as a dynamic process, having the quality of being able to change and evolve gradually. This perspective is more closely related to the definition of resilience by UN/ISDR. Resilience is:

> the capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organising itself to increase this capacity for learning from past disasters for better future protection and to improve risk reduction measures.[57]

Development can never be risk-neutral.[58] Technological changes, such as GM crops and cloning, will have risks associated with them. As technological advances become increasingly complex and tightly coupled, accidents are inevitable or "normal."[59] This is true for both small and large-scale developments and is not limited to technological development. Political and economic developments and their geopolitical consequences can act as sources of conflict.[60]

Resilience, as a process, has its focus not on what is missing in a crisis, namely needs and vulnerabilities, but on what is already in place, namely resources and adaptive capacities. Resilience is not a science, it is a process, using human capacity and ingenuity to mitigate vulnerabilities and reduce risks, both of which are socially constructed. As Alvin Weinberg points out in his paper on the role of the regulator, "Science deals with regularities, Art deals with singularities."[61] And it is the human dimension of response to unique events that shapes resilience. Thus, enhancing resilience involves engagement at all levels. As David McEntire states:

> recognizing the human role in disasters, taking responsibility for action, having a disaster plan, building capabilities to implement the plan, purchasing insurance, and sharing information about recovery priorities are processes that can enhance resilience for an individual, group, community or nation to deal with unique destabilizing events. In this instance, resilience is thus a goal that we should strive to achieve or a quality that we should try to obtain.[62]

Both perspectives on resilience, whether outcome or process focused, have the same goal: the reduction of disaster risk. But there are contrasts between the two perspectives (See Table 1). In addressing the focus of the changes to UK emergency

Table 1: Resilience and Disaster Management

DOMINANT PARADIGM	NEW PARADIGM
Isolated Event	Part of Development
Risk Not Normal	Risk of Disaster/Conflict
Techno-legal	Social Capacity
Centralized	Participatory
Low Accountability	Transparent
Post Event Planning	Predisaster Plans
Status Quo Restored	Transformation
Cross-Cutting Theme: Public Education	

preparedness on institutional resilience, Table 1 provides a useful way of considering the overly centralized nature of UK reform. This should not imply that one perspective is more credible than the other. As Bernard Manyena, a researcher at the Disaster and Development Centre of Northumbria University points out in an analysis of the resilience debate, policymakers can choose one of the approaches discussed earlier or decide to embrace both. The key issue they need to recognize is that mainstreaming resilience building, through people, is core to disaster risk reduction and recovery either way. Fundamentally, emergency management is both a top-down and bottom-up process and must be people-oriented.[63]

The terminology of the left hand column characterizes the UK approach. The events that propelled the United Kingdom into changes to civil protection, the Millennium Bug, floods and the Fuel Blockade, were a series of isolated, unconnected events. Further, September 11th had a profound effect on the direction and emphasis of the changes to UK civil protection. Despite the United Kingdom having had experience of traditional terrorism, in which the foci of attack were either symbolic or economic as opposed to mass casualties, suicide was not involved and warnings were given, the prospect of terrorism that focuses on mass fatalities with no regard for self-preservation, was new to the United Kingdom. In that sense, these risks were outside of what is considered normal. This is not meant to imply that the traditional terrorism experienced in the United Kingdom was normal. There are nevertheless parallels that can be drawn between responses to this older form of terrorism and the response to September 11th with regard to civil protection. The response to traditional terrorism was the use of a centralized police and military system, including the placement of troops in Northern Ireland, to deal with what was ostensibly a war situation, the use of intelligence and surveillance coupled with legislative instruments for specific purposes, for example internment, with the purpose of returning to a peaceful situation. The campaign in Northern Ireland was in many

ways secretive. The response to September 11th involved a series of changes to the legislative base and investment in new technologies to beat the terrorist threat. The system is centralized, responsible only to senior government figures, and the capabilities aspects are concerned with a return to normality. What cannot be determined is the shape and direction UK resilience would have taken had September 11th not occurred. What can be concluded is that following this event the UK government adopted the dominant paradigm approach with a particular focus on the resilience of institutional and organizational capacity.

Hazards may be natural in origin but it is our relationship to hazard that produces risk.

This approach is very different from the paradigm set out in the right hand column, which has been somewhat influenced by and based on experiences of working with groups and communities exposed to natural hazards, usually as part of developmental programs. As discussed above, hazards may be natural in origin, but it is our relationship to hazard that produces risk. In that sense disaster is not natural. Risk to human populations is a function of frequency of a hazard event, its severity and people's vulnerability.[64] Vulnerability depends upon many factors that influence the amount of damage and loss of human life that a particular hazard can cause. These factors include exposure, physical susceptibility, socioeconomic fragility and lack of resilience.[65] However as the new paradigm suggests, resilience results in a transformation or adaptation to the situation and not a return to the status quo. This is more appropriate when considering many of the threats now faced. A striking example of this is the case of New Orleans in the aftermath of Hurricane Katrina. There seems little prospect of a return to normal in terms of long-term recovery. Research suggests that radical changes to both the city and its surrounding environment are needed. Parts of the city appear to be indefensible and the erosion of surrounding coastal areas that offer protection, attributed to anthropogenic intervention, has to be initially halted and then reversed. There are some voices that claim the city may have to be abandoned in the longer term.[66] Whatever the outcome, the future of New Orleans will be one of transformation. This brings us to the final row in Table 1. For long-term problems such as climate change that may mean radical changes to the ways in which we live, clear engagement with the public is vital. In terms of effective emergency management, the cross-cutting theme of public education is an integral component, yet it is often poorly handled.[67] In response to changes in civil protection, the UK government distributed a brochure entitled "Preparing for Emergencies" to every household in 2004.[68] The slant of the brochure was toward terrorism. It explained, for example, what to do if trapped in debris resulting from a bomb explosion and clarified that airline cockpits have reinforced and locked doors to prevent hijacking. One of the main messages promulgated is to

stay indoors and wait for announcements on either the radio or television. This is not a structured or detailed approach to public education nor a meaningful attempt to encourage public dialogue.

At the local level, the Civil Contingencies Act places a duty on emergency response organizations to assess risks and to produce co-operatively a Community Risk Register (CRR).[69] The guidance set out in the Regulations shows ambivalence about how much of this should be made public. It advises that whilst the act requires publication of risk assessments and the CRR, this in turn requires agreement of partners—both category one and two responders, such as utilities, transport bodies, strategic health bodies and the Health and Safety Executive—and is subject to security and confidentiality restrictions.[70] It is likely that different jurisdictions will arrive at different agreements about what information to make available to the public. This could lead to a position in which adjoining jurisdictions that share a common risk may decide differently about whether or not to inform their publics.

Putting up the Barricades

The United Kingdom is no stranger to terrorist attacks. Irish Republican terrorism aimed, usually, at politically or economically sensitive targets in the London and other parts of the United Kingdom, has occurred over a number of years. In the 1980s and 1990s, the UK government took steps to design out terrorism using the defensible spaces principle, for example blocking off car parking areas near sensitive locations to prevent car bomb attacks and removal of litter receptacles from all mainline railways station platforms to prevent the placement of bombs. Fortification became a feature of the London landscape with Downing Street fenced off and the City of London protected by a ring of steel.

A study conducted in 2003 into the risk of a terrorist attacks identified London as a "top terrorist target," and the city has been on a higher risk rating of attack than the rest of the United Kingdom.[71] Metropolitan Police Commissioner Sir John Stevens said a week after the Madrid bombing, that an attack on London was inevitable.[72] Although the process of fortifying against attacks has not relented, more sophisticated technologies, or softer measures, have been deployed. For instance, the average Londoner is thought to be photographed some 300 times a day by digital surveillance equipment.[73] The militarization of urban space lacks transparency and scrutiny, is often promoted in the guise of traffic management or deterring crime, and raises questions about freedom of movement and civil liberties.[74] Other measures, such as proposals to introduce identification cards should be understood against the background of accusations of "control freakery" by the UK government, made by Sir Alistair Graham, the chairman of the Committee of Standards in Public Life, compounded by the admission by the Home Office secretary, Charles Clarke, that ID cards would not have prevented the July 7th attacks.[75]

The changes to UK civil protection were implemented to reform weaknesses that had been exposed by a series of events at the turn of the millennium. This article argues that September 11th deflected the development of UK resilience towards the dominant paradigm outlined in Table 1 and a focus on terrorism. In the author's view this also means a disturbing move towards militarization, centralization and a curtailment of civil liberties. The fixation on terrorism in the United Kingdom has some resonance with developments in the United States. There are some that fear the rise of the Department of Homeland Security and the downgrading of FEMA and the shift of emphasis from the *"all hazards approach"* [author emphasis] to *"homeland security"* [author emphasis] could mean too great a focus on terrorism as opposed to the plethora of threats faced by the United States.[76] These concerns do not mean that terrorist threats should be ignored or downgraded, but that a balanced approach is needed; one that recognizes the need to respond meaningfully to the range of threats faced.

However, like in the United States, legislative measures proposed by the UK government in its war against terror have raised fears of moves towards to a more repressive and anti-liberal stance. For example, the Prevention of Terrorism Bill introduced by the government proposed measures that would allow the detention of terrorist suspects for ninety days without charge. Paddy Hillyard likened this to a return to the days of internment in Northern Ireland.[77] Internment, introduced in 1971, allowed the detention of terrorist suspects without trial. Internment flouted international human rights standards. Many of those arrested were subjected to inhuman and degrading treatment. Reginald Maudling, the then Home Secretary that sanctioned the policy, writing years afterward, described internment as "an unmitigated disaster."[78] The internment policy was terminated in 1975. In addition, Victoria Mantouvalou argued that the proposed Prevention of Terrorism legislation could move the United Kingdom in the wrong direction and that the government should not give into pressures to adopt anti-liberal repressive policies, a move that could be interpreted as a victory for the terrorist.[79] Despite a large majority for the Labour Party in the Parliament, the UK government was defeated on this issue.

The average Londoner is photographed some 300 times a day.

Though this may be regarded as a victory it is the general direction that is of concern. While Lagadec and Mantouvalou both conclude that the introduction of repressive measures could be interpreted as a victory for terrorism, others claim that the "erosion" of civil liberties is justifiable in the war on terror. This is the point made by Dame Eliza Manningham-Buller, the head of the UK intelligence service MI5, in a speech shortly after the July 7th bomb attacks in London.[80] Charles Clarke, the Home Secretary, claims that measures to extend the period for the reten-

tion of information (excluding content) on calls, text messages and internet data that can be accessed by Police services to up to two years, which were proposed by the United Kingdom and agreed upon by the EU during the UK presidency, are a sign of EU solidarity in the fight against terrorism.[81]

Whilst the author supports the need to act to prevent terrorist attacks, recent developments could be interpreted as being more sinister. The United Kingdom is a heavily surveilled society. Technological developments, if not regulated properly in an open and transparent way, could be used for purpose other than fighting terror. Despite the admission that ID cards would not have prevented the July 7th attacks, the UK government is still pressing ahead. Recent reports into DNA databases have exposed the lack of control over data of this type. Twenty-four thousand DNA records of young people aged between ten and eighteen have been stored despite them never having been cautioned, charged or convicted of an offense. The Home Office announced in January 2006 that around 7 percent of the UK population would have DNA records stored. This compares to the EU average of 1.13 percent and 0.5 percent in the United States.[82] Technological developments such as Automatic Number Plate Recognition (ANPR) that recognizes vehicle registrations from both fixed and mobile platforms, used currently for the Congestion Charging scheme in London, are to be introduced in twenty-three police authorities in the United Kingdom.[83] This means that eventually vehicles will be able to be tracked throughout the United Kingdom. This, along with proposals to introduce biometric passports and the other developments on monitoring movements, communications and personal data suggests, according to Statewatch, an agenda beyond that of just addressing terrorism.[84] In the wrong hands or without open and transparent controls, data of this kind could be used for oppressive purposes. In the author's view this creeping process of control, disguised as the war on terror, has resonance with the narrative of the Fortress World scenario.[85]

Some claim that "erosion" of civil liberties is justifiable.

Toward a Broader Resilience Agenda

The duty of a government is to protect society against threats, but too great a focus on one type of threat and on institutional preparedness can divert attention away from other problematic areas and distance the public. The United Kingdom, in common with other countries, faces many challenges. For instance, climate change has been described by the UK chief scientific advisor, Sir David King, as a greater threat than terrorism.[86] An estimated 35, 000 people died in Europe in 2003 from the effects of a heatwave, believed to be linked to climate change. The Earth Policy Institute claims that "far greater" loss of life from such events will occur in the future.[87] The response in the United Kingdom to this source of threat has been insti-

tutional. The National Health Service (NHS) is gearing up for hot weather episodes to protect the frail and elderly, predicated on the Intergovernmental Panel on Climate Change's (IPCC) projections of a warming world and experience from 2003 that resulted in a 60 percent increase of in deaths of people aged over seventy-five.[88]

Meanwhile, the threat of an avian influenza pandemic gives the clearest indication of the government targeting institutional and organizational resilience.[89] And concern amongst the public about avian influenza boosted the demand for influenza vaccination, which does not provide immunity to avian influenza, to the point that some parts of the UK began to run out of supplies.[90] This is despite repeated official announcements that it would not help.

Since the BSE epidemic, public trust in officialdom has been low, a problem acknowledged by government.[91] A survey conducted by MORI in 1999 into the public's assessment of the government's handling of risks, showed that they believed that issues such as pollution, crime and genetically modified food had been poorly handled. When asked specifically what sources of information they trusted with regard to the BSE epidemic, government ministers were seen as the least trustworthy.[92] People have increasingly utilized non-governmental sources and arrived at their own views on risk, which is not surprising given increasing availability of non-governmental information resources such as the World Wide Web.

This issue lies at the core of risk and governance. If, as Jassanoff argues, distancing an actor weakens the risk management chain, then some sort of redress is needed.[93] Climate change offers a good example of the kind of approaches that should be adopted in order to redress the risk management chain. Though there is no agreed figure for the level of greenhouse gas reduction, there is general agreement that significant cuts are needed. Energy is fundamentally important and reducing greenhouse gas emissions will mean shifting to low or no carbon energy sources and reducing the amount of fossil fuels used. To do so requires both technological changes and lifestyle changes. This means a holistic approach involving all actors. The public is the major user of energy services and changes in public behavior will determine the success of approaches to changing the energy system. But the debate in the United Kingdom is narrowly focused on supply-side issues with little effort to engage the wider public. This behavior is in stark contrast to approaches by some of the UK's European neighbors. Government interventions in Germany aimed at involving the public in alternative energy systems have seen impressive take-up and heightened levels of public awareness, with the wind energy turbine industry second to Denmark and a photovoltaics (PV) industry second to Japan.[94]

The threats faced are challenging and certain to become more so over time.[95] Preparedness is a concomitant process requiring engagement of all actors. In the case of the United Kingdom, this means that the government must begin to involve the wider public in meaningful and open discussion. Pursuing institutional resilience

and focusing on too narrow a range of threats only serves to increase the distance between government and governed. To successfully do this, the second paradigm of resilience must be incorporated in the first.

NOTES

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[2] Ulrich Beck, *Risk Society: Towards a New Modernity* (London: Sage, 1992); Ulrich Beck, *Ecological Politics in an Age of Risk* (Cambridge: Polity Press, 1995).

[3] Sheila Jasanoff, "Civilisation and Madness: The Great BSE Scare of 1996," *Public Understanding of Science* 6, no. 3 (1997); Bruna De Marchi and Jerome R. Ravetz, "Risk Management and Governance: a Post-normal Science Approach," *Futures* 31, no. 7 (1999): 743-757.

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[6] Jasanoff.

[7] James K. Mitchell, ed., *The Long Road to Recovery: Community Responses to Industrial Disaster* (Tokyo: United Nations University Press, 1996).

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[12] This experience is unique in terms of disaster management, as it is the only episode the author is aware of, where the disaster management community knew exactly when the event would occur.

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Appendix 8

Energy, Poverty, Climate Change: The Way Forward,
EASE (Enabling Access to Sustainable Energy)
Vol 3 pp 7-9

O'Brien, G. O'Keefe, P. (2006)

ENERGY, POVERTY, CLIMATE CHANGE:

THE WAY FORWARD

After elaborating on the linkages between energy and poverty, this article searches for win-win opportunities that could contribute to solving the problems of energy poverty and global warming. Geoff O'Brien and Phil O'Keefe suggest that what is needed is a mechanism that does not link technology transfer to emission reductions in the developed world and recognizes that small scale is the way forward.

Geoff O'Brien and Phil O'Keefe

About one quarter of the global population, some 1.6 billion people, have no access to electricity, and 2.4 billion people rely on wood, charcoal or dung as their principal source of energy for cooking and heating. This fuel is literally killing people: two and a half million women and children die each year from the indoor pollution from cooking fires.

The problem we face is not a lack of energy, the earth is awash with energy, but a lack of access to energy services. Energy and poverty are interlinked: if we are to make progress in meeting the MDGs of eradicating hunger and poverty then, as the UN Commission on Sustainable Development states, "to halve the proportion of people living on less than one dollar per day by 2015, access to affordable energy services is a prerequisite".

Poor people spend up to a third of their income on energy, mostly used to cook food. Women, in particular, devote a considerable amount of time to collecting, processing and using traditional fuel in cooking. In many countries, two to seven hours each day can be devoted to the collection and transportation of fuel for cooking. This is time that could be spent on child-care, education, socialising or income generation.

Escape from Poverty

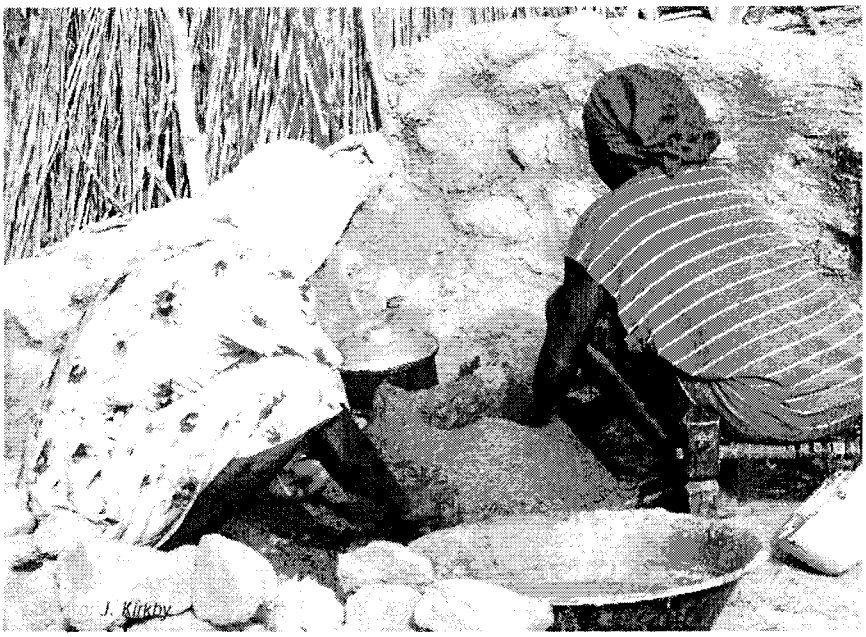
Though energy and poverty are interlinked, energy (or rather the lack of access to energy services) is just one dimension of poverty. To escape poverty also requires, among other things, clean water, adequate sanitation and health services, a good education system and a communication network. Yet, cheap and available energy is essential. Electricity provides the best form of lighting; and many household appliances run on it. Kerosene and liquefied petroleum gas (LPG) are more energy-efficient cooking fuels than traditional biomass. Diesel and other fuel oils are more cost-effective for space heating. Diesel, gasoline and LPG are, and will remain, the primary transport fuels.

Modern energy services can enhance the life of the poor in countless ways. Electric light extends the day, providing extra hours for reading and work. Modern cookstoves avoid daily exposure to noxious cooking fumes. Refrigeration allows local clinics to keep needed medicines on hand. Further, modern energy can directly reduce poverty by raising a poor country's productivity and extending the quality and range of its products – thereby putting more wages into the pockets of the deprived.

It is clear that tackling energy poverty has to be part of an overall strategy for tackling poverty. This is a major challenge since about half of the developing world's population rely on biomass fuels for cooking and heating. This is especially true in rural areas where many currently live, but urbanisation is advancing rapidly and much of the energy economy in these new urban areas is still based on biomass fuels, particularly wood and charcoal (Hardoy et al., 2001). This, coupled with population growth and land clearance for increased agriculture, is leading to deforestation.

The Ultimate Win-Win Situation

Are we really awash with energy? Yes, and the fundamental source is the sun -



each year it delivers 10,000 times the energy that humans currently use (Swain, 2003). The problem we have is not an energy shortage, but a lack of effective means to transform this wealth of energy into the services we need. Solving this problem in ways that reduce the production of global-warming gases is the ultimate win-win situation. So why are we not making progress? Firstly this is not quite true, we are making progress. Many technologies are available and our experience with them is growing rapidly. The problems are not resource availability or technological capability but lie elsewhere - broadly speaking the problems are institutional.

Greenhouse gas production arises from industrialisation, the process that has transformed what are now termed the OECD nations. The energy sector that has underpinned this transformation has developed around the availability of cheap fuel - coal, oil and gas. Technological development has seen the construction of grids to transport electrical power long distances to where it is needed. Refining capacity for crude oil has developed around deep-water ports enabling the use of vast sea-going tankers to transport resources. Infrastructure to exploit offshore oil and gas sources has also been developed. All of this reflects huge investments. Changes in the ownership of this system, from state control through privatization, have seen the commodification of energy.

Energy is now seen as a commodity to be delivered at least cost, as opposed to a service vital to human wellbeing. Every year, new power plants, refineries, pipelines and other forms of conventional infrastructure - facilities that will be around for at least a half-century - are added to the global energy system to replace existing capital stock and to meet ever-rising demand, much of it in the developing world. An estimated $200–250 billion is invested in energy-related infrastructure each year, with nearly all of this going to conventional energy, and another $1.5 trillion is spent on energy consumption. As a result, societies are in the process of further locking themselves into a dependence on unhealthy, unsustainable, and insecure energy structures (Swain, 2003)

Sustainable Energy Systems

If alternative, sustainable energy systems are to make a positive contribution to sustainable development at the local level, they will need to be appropriate, easy to use and maintain, culturally acceptable and affordable. The energy ladder will have to be adapted to suit local conditions: for example, in areas where there is plenty of sunshine, solar technologies will predominate, and in areas where water power is available then micro-hydro will be on a lower rung. There is no one size fits all solution! An analysis of both needs and resources should form the basis of an energy strategy, and there is a need to develop resilient energy systems that will evolve and adapt. These should be based on available renewable sources, efficiency, appropriateness to need, reliability, adaptability, repairability and ease of use and, crucially, involve local people in their development, implementation and operation.

One further aspect to take into account is climate change: a resilient energy system is one that can cope with climatic extremes. The IPCC predicts that weather patterns will become less predictable and there are likely to be more extreme events. Developing systems that are unable to withstand extreme conditions or that are too complex and/or expensive to repair in the event of damage, or locating such capacity in vulnerable areas, is not a long term solution.

Small Scale Tech... Appropriate

It will not be easy to effect a transition to a more sustainable energy system. The IEA estimates that some 1.6 billion people are not connected to a grid, and that some 1.4 billion people will still be in that position in 2030 (IEA, 2002). Clearly, we need to develop energy sys-

Photo: R. van der Heul

tems that do not rely on the development of grid capacity. Further, there is still an over-emphasis on large scale technology transfer – where what is needed is small scale. This will be a challenge for the international community, particularly for the Conference of the Parties (COP), the governing body of UNFCCC and responsible for the Kyoto Protocol and the associated mechanisms such as the Clean Development Mechanism (CDM). It will have to use all of its influence to persuade the international community involved in the energy sectors of the developing world to support strategies that are truly sustainable.

History to date does not make comfortable reading. Many projects are focussed on taking advantage of the carbon trading market rather than promoting sustainable development. International financial organisations such as the World Bank have a poor record in promoting renewables. In the ten years after UNCED, the World Bank invested some $22 billion in oil, gas and coal projects as opposed to $1 billion in renewables. Carbon trading has been hailed by the Bank as carbon with a human face, and the BioCarbon fund is supposed to bring carbon finance to the world's poor. However, the reality is that the CDM carbon market is bypassing the poorest countries and the poorest communities in developing countries. In fact, the CDM has almost completely bypassed Africa (CDMWatch, 2005).

The Way Forward

Despite the falling prices of renewables, it seems that without a complete overhaul of the funding mechanisms they will always be at a disadvantage. As it stands, a multiplicity of small projects does not have the same attraction for large institutions like the World Bank or for large industrial players in the developed world. What is needed is a mechanism that does not link technology transfer to emission reductions in the developed world and recognizes that small scale is the way forward. The potential market is vast given that there are 1.6 billion people without access to any other energy resource than biomass. Even small-scale projects can be financially attractive on that scale of market with the right funding mechanisms. Perhaps one needs a new perspective. Mitigating climate change is in everyone's interest, and as the developed world remains the main producer of greenhouse gases, and has the technology to reduce emission levels, perhaps a system should be developed to foster technology transfer that promotes sustainable development at no cost to the host. Funding could be raised by diverting current subsidies (estimated at between $250 - 300 billion per year) away from non-renewable technologies (fossil and nuclear) into supporting technology transfer.

Who should be leading the calls for such changes? In many ways it should be a joint effort by the international community but, for credibility, those most closely associated with trying to develop mechanisms and policies for dealing with climate change should take the lead. The current commitment period runs up to 2012, and there are indications that signatories to the Protocol will need not meet their targets. In this situation, there is a need to re-think the shape and purpose of future policies aimed at mitigating climate change. Perhaps it is time to think of more radical approaches that address the institutional barriers that prevent a move to sustainable and resilient energy systems?

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Appendix 9

Pre-Disaster Planning and Climate Change
Working Paper, NCAP (Netherlands Climate Impact Programme)

O'Brien G. (2006)

Working Paper

Pre Disaster Planning and Climate Change

Note prepared by Geoff O'Brien at NCAP meeting, held in Holland, May 2006

Introduction

Accelerated climate change and increasing climate variability caused by anthropogenic greenhouse gas emissions is the single largest environmental problem to the attainment of sustainable development. Kyoto implies recognition of a Polluter Pays Principle that underpins the agreement which addresses both mitigation and adaptation. It is important that mitigation remains the central strategy because unequal pollution of the global climate commons is inequitable and continuation demonstrates neglect of environmental sensibility. Adaptation however also needs to be addressed including the issue of compensation. While there are many approaches to adaptation it is perhaps best captured in a widened form of pre-disaster planning. Quite simply it is cheaper to prevent by adaptation than to respond to the increasing cost of climate impact.

Sustainable Development and Adaptation

Sustainable development is a process aimed at reducing risk, both now, and in the future. Climate change and climate variability is, and will continue, generating increasing risk. Mitigation has its focus on reducing risk in the future. Adaptation has its focus on reducing risks, both now and in the future, that are being generated by the greenhouse gases that have already been loaded into the atmosphere. Development activities must factor in climate change variability if they are to be regarded as being sustainable. This means that adaptation measures must be an integral part of the sustainable development agenda. Reducing the risk of vulnerable communities to climate change variability means ensuring that development planning incorporates adaptation measures.

From Reactive to Proactive Disaster Management

Approaches to disaster management take two broad forms; relief and recovery or an all hazards approach. The objective of both approaches is a return to normal. Climate change variability can be described as both a complex and protracted hazard and as such does not sit comfortably in either of these response regimes. It is a natural phenomenon that is exacerbated by anthropogenic

emissions of greenhouse gases. It is a multifaceted (from drought to flood) and multidimensional (from local to global) hazard that has short-, medium- and long-term aspects and unknown outcomes. Table 1 shows a typography of climate change related hazards.

Table 1: Typography of Climate Change Hazards

Description	**Onset**	**Duration**
Flood	Rapid and predictable	Long
Storm	Rapid and predictable	Short
Drought	Slow	Long
Disease	Slow and unpredictable	Long
Sea level rise	Slow	Permanent
Land slides	Rapid and unpredictable	Short
Glacial Lake Outburst Flood (GLOF)	Rapid and unpredictable	Short
Changes in precipitation patterns	Slow	Long
Heatwaves	Slow	Long
Desertification	Slow	Permanent
Changes in vegetation patterns	Slow	Long
Changes in fisheries	Slow	Long
Replenishment of underground water stores	Slow	Long

While this table does not capture the full range of climate change and variability related hazards, it does indicate the diversity of problems. Tackling these requires a systematic and comprehensive approach. Further, it should not be forgotten that we already have a climate change and variability episode driven by historic emissions that we cannot avoid. This means that we need to look to a new paradigm or approach for dealing with climate change disaster management. The following section sets out the principles that should underpin this approach.

Principles underpinning Pre Disaster Planning: Developing Resilience

The convergence of international agendas for sustainable development and disaster reduction and the link to the Millennium Development Goals (MDGs) is now increasingly recognized throughout the international community and is clearly articulated in the Hyogo Declaration of the United Nations International Strategy for Disaster Reduction (UN/ISDR) 2005 World Conference: "We recognize the intrinsic relationship between disaster reduction, sustainable development and poverty eradication, among others."[1] The declaration identifies that pre-disaster planning and a culture of prevention and resilience as key components at all levels to reduce risk and that knowledge of societal vulnerabilities are the starting point for actions. Actions are framed around governance, risk identification and reduction and preparedness.[2] This global declaration is relevant to all nations and recognizes the equal importance of both bottom-up and top-down approaches.

The term resilience has increasingly entered the disaster management debate and is seen through a number of theoretical perspectives. Broadly there are two schools of thought or definitions of disaster resilience in the disaster reduction debate. The first can be stated as an outcome-oriented and the second as process. The first instance can be broadly viewed as coping or withstanding and returning to normal after a shock. This perspective implies that there is some minimum standard for societies in terms of their ability to cope and is essentially top-down or command and control approach. This is the dominant paradigm in disaster management.

The second viewpoint sees resilience as a process, meaning that it is essentially dynamic and has the quality of being able to change and evolve. This perspective is more closely related to the definition of resilience by UN/ISDR:-

> *"The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organising*

[1] UN/ISDR, World Conference on Disaster Reduction, *Hyogo Declaration*, paragraph 2, 18-22 January 2005, Kobe, Hyogo, Japan. <http://www.unisdr.org/wcdr/intergover/official-doc/L-docs/Hyogo-declaration-english.pdf>
[2] UN/ISDR, paragraphs 3,9,17, 2005.

itself to increase this capacity for learning from past disasters for better future protection and to improve risk reduction measures." [3]

Resilience, as a process, has its focus not on what is missing in a crisis (needs and vulnerabilities), but on what is already in place (resources and adaptive capacities). Resilience is not a science, it is process, using human capacity and ingenuity to mitigate vulnerabilities and reduce risks, both of which are socially constructed.

Both perspectives on resilience, whether outcome or process focused, have the same goal, the reduction of disaster risk. The contrasts to both perspectives on resilience are summarized in Table 2. Policy-makers can choose one of the approaches discussed earlier or decide to embrace both. The key issue that needs to be recognized is that mainstreaming resilience building, through people, is core to disaster risk reduction and recovery. In reality disaster management is both a top-down and bottom-up process but with a people focus.

Table 2: Resilience and Disaster Management

Dominant Paradigm	**New Paradigm**
Isolated event	Part of development
Risk not normal	Risk of disaster/conflict is an everyday condition
Techno-legal	Social capacity
Centralized	Participatory
Low accountability	Transparent
Post event planning	Predisaster plans
Status Quo restored	Transformation
Cross-Cutting Theme – Social Learning	

Pre-disaster planning as practiced today is based on risk assessment and lessons learned. Its aim is to reduce risk. It cannot stop hazardous events from occurring, for example, a flood event. But it can help to reduce risk during the event, for example, by zoning laws that prevent development in

[3] UN/ISDR, 2005, p4

those areas that are known to flood. Climate change variability both exacerbates current risks, for example, changing precipitation patterns leading either floods or droughts as evidenced in the case study from Tanzania, and presents new risks, for example, Glacial Lake Outburst Floods (GLOF) as evidenced in the Bhutan case study. Events driven by climate change variability can mean that a return to normal is not possible, for example, increasing droughts that require a change in agricultural and pastoral practices that are evidenced in the case study Mongolia.

Assessing the risk to vulnerable communities and systems the climate change driven episodes presents is the starting point. Social learning is the vehicle to empower communities to employ methods to identify adaptive strategies that will respond to changing conditions. Institutional responsiveness is an essential component for ensuring that pre-disaster planning feeds both up and down throughout the structure. In this way pre disaster planning can help to reduce risk at the local level and strengthen responses at the national level.

Attempts at adaptation to the impacts of climate change can build on existing mechanisms of adaptation by human beings to new circumstances. Social learning plays a central role among these mechanisms.

Social learning takes place both within and between groups, organization and domains. With a domain we mean a social entity where the participants share a certain outlook and act accordingly. Examples of outlooks are often defined in polarities such as between bottom-up and top-down, technological and social, regional and sectoral, traditional and modern, planned and spontaneous, continuity and innovation and continuation.

Social learning within domains may tend to develop through the interactions between people in a certain, predictable line, whereas social learning in the interactions between people of different domains can be more difficult, create additional problems and function as windows for change.

For a policy purpose the existing inter-domain interactions open up opportunities to redirect social learning towards a certain goal such as adaptation to the impacts of climate change. Also new inter-domain interactions can be created and directed towards the same policy purpose.

At these old and new interfaces between domains various ways of stakeholder involvement can be applied. Social learning can take place among the participants from different domains. And the participants can then introduce the newly acquired ideas in their respective domains.

Structural Principles: Bottom Up and Top Down

The role of government is to promote the well-being of the people it represents. Developing a policy framework to protect the public wherever possible and support recovery when disastrous events impact the public is the role of government and is seen as promoting the public good. The role of government is the same in terms of protecting the public from the threats of changing climatic conditions. Government, through its links with the public, has a role in ensuring that pre-disaster planning incorporates, not only through its policy frameworks but is also embedded in programmes and projects, whether externally or internally funded, to ensure that activities being undertaken, or planned, measures to reduce climate change risk.

Ensuring that pre disaster planning is people focused and integrated from national to local means that we have to put together the competing paradigms of disaster management. The case study from Bangladesh highlights this two way approach, bottom up and top down, to ensuring that pre disaster planning is embedded throughout the civil society and the institutional and political structures. Table 3 expresses a series of guiding principles to shape the ways that pre disaster planning develops.

Table 3. From Competing Paradigms to New Principles

Pre Disaster Planning Principles
Sustainable Development
Risk Avoidance
Embedded in Policy and Practices
Distributed to the appropriate level
Shared responsibility
Learning from scientific evidence, indigenous knowledge and experience
Adjusting to changes
Institutional Development and Social Learning

As the group were finishing this work, they were able to access the World Bank's Independence Evaluation Groups report "Hazards of Nature, Risk to Development" (April 2006). Though the bank largely concentrates on its experience with structural damage in natural hazards, it makes a strong case for the development of an emergency plan that preserves social networks and provides livelihood opportunities; it also emphasis consideration of gender difference in designing response. Its most useful list however is on how to avoid disastrous response to disaster. It argues do not ignore local leadership; do not ignore the socially vulnerable. Use local materials and knowledge and do not move people away from their jobs. Most importantly it says avoid reacting instead of planning ahead, especially **where disasters will happen** even if we do not know the timing, the frequency or the intensity of the disaster. We share that message.

Appendix 10

Declarations

Co- Authorship of Published Work

northumbria UNIVERSITY

DECLARATION OF CO-AUTHORSHIP OF PUBLISHED WORK

(Please use one form per co-author per publication)

Section A

Name of candidate: **Geoff O'Brien**

Name of co-author: **Paul Read**

Full bibliographical details of the publication (including authors):

O'Brien G., Read P., 2005, Future UK Emergency Management: New Wine, Old Skin?, Disaster Prevention and Management, Vol, 14(3) pp 353-361. Emerald UK

Section B

DECLARATION BY CANDIDATE (delete as appropriate)

I declare that my contribution to the above publication was as:

(i) principal author

~~**(ii) joint author**~~

~~**(iii) minor contributing author**~~

Signed: Geoff O'Brien (candidate) 1/11/07 (date)

Section C

STATEMENT BY CO-AUTHOR (delete as appropriate)

Either **(i) I agree with the above declaration by the candidate**

or ~~**(ii)**~~ **I do not agree with the above declaration by the candidate for the following reason(s):**

Signed: P Read (co-author) 22/02/08 (date)

northumbria UNIVERSITY

DECLARATION OF CO-AUTHORSHIP OF PUBLISHED WORK

(Please use one form per co-author per publication)

Section A

Name of candidate: **Geoff O'Brien**

Name of co-author: **Mary Mellor**

Full bibliographical details of the publication (including authors):

Giddings, R., Hopwood, W., Mellor, M., O'Brien, G., 2005, Back to the City: A route to urban sustainability. In Jenks M, Dempsey N (eds) Future Forms and Design for Sustainable Cities. Architectural Press, Elsevier, Oxford, UK

Section B

DECLARATION BY CANDIDATE (delete as appropriate)

I declare that my contribution to the above publication was as:

~~(i)~~ **principal author**

(ii) joint author

~~(iii)~~ **minor contributing author**

Signed: Geoff O'Brien (candidate) 1/11/07 (date)

Section C

STATEMENT BY CO-AUTHOR (delete as appropriate)

Either **(i) I agree with the above declaration by the candidate** ✓

or ~~(ii)~~ **I do not agree with the above declaration by the candidate for the following reason(s):**

Signed: Mary Mellor (co-author) 12.12.07 (date)

northumbria UNIVERSITY

DECLARATION OF CO-AUTHORSHIP OF PUBLISHED WORK

(Please use one form per co-author per publication)

Section A

Name of candidate: **Geoff O'Brien**

Name of co-author: **Mary Mellor**

Full bibliographical details of the publication (including authors):

Hopwood B. Mellor M. O'Brien G.. 2005, Sustainable Development: Mapping Different Approaches, Sustainable Development (13) pp38-52. John Wiley & Sons and ERP Environment

Section B

DECLARATION BY CANDIDATE (delete as appropriate)

I declare that my contribution to the above publication was as:

(i) principal author

(ii) joint author

(iii) minor contributing author

Signed: Geoff O Brien (candidate) 1/11/07 (date)

Section C

STATEMENT BY CO-AUTHOR (delete as appropriate)

Either **(i) I agree with the above declaration by the candidate**

or **(ii) I do not agree with the above declaration by the candidate for the following reason(s):**

Signed: Mary Mellor (co-author) 12.12.07 (date)

northumbria UNIVERSITY

DECLARATION OF CO-AUTHORSHIP OF PUBLISHED WORK

(Please use one form per co-author per publication)

Section A

Name of candidate: **Geoff O'Brien**

Name of co-author: **Ben Wisner**

Full bibliographical details of the publication (including authors):

O'Brien G. O'Keefe P. Rose J. Wisner B., 2006, Climate Change and Disaster Management, Disasters 30(1):64-80. Blackwell

Section B

DECLARATION BY CANDIDATE (delete as appropriate)

I declare that my contribution to the above publication was as:

~~(i)~~ **principal author**

(ii) joint author

~~(iii)~~ **minor contributing author**

Signed: Geoff O'Brien (candidate) 1/4/07 (date)

Section C

STATEMENT BY CO-AUTHOR (delete as appropriate)

Either **(i) I agree with the above declaration by the candidate**

or ~~(ii)~~ **I do not agree with the above declaration by the candidate for the following reason(s):**

Signed: [signature] (co-author) 6 Jan 2009 (date)

northumbria UNIVERSITY

DECLARATION OF CO-AUTHORSHIP OF PUBLISHED WORK

(Please use one form per co-author per publication)

Section A

Name of candidate: **Geoff O'Brien**

Name of co-author: **Bob Giddings**

Full bibliographical details of the publication (including authors)**:**

Giddings B. Hopwood B. O'Brien G., 2002, Environment, Economy and Society: Fitting them together into Sustainable Development, Sustainable Development (10) pp187-196. John Wiley & Sons and ERP Environment

Section B

DECLARATION BY CANDIDATE (delete as appropriate)

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~~(i)~~ **principal author**

(ii) joint author

~~(iii)~~ **minor contributing author**

Signed: Geoff O'Brien (candidate) 1/11/07 (date)

Section C

STATEMENT BY CO-AUTHOR (delete as appropriate)

Either **(i) I agree with the above declaration by the candidate**

~~**or**~~ ~~**(ii) I do not agree with the above declaration by the candidate for the following reason(s):**~~

Signed: B Giddings (co-author) 12 Dec 2007 (date)

northumbria UNIVERSITY

DECLARATION OF CO-AUTHORSHIP OF PUBLISHED WORK

(Please use one form per co-author per publication)

Section A

Name of candidate: **Geoff O'Brien**

Name of co-author: **Bob Giddings**

Full bibliographical details of the publication (including authors)**:**

Giddings, R., Hopwood, W., Mellor, M., O'Brien, G., 2005 Back to the City: A route to urban sustainability. In Jenks M, Dempsey N (eds) Future Forms and Design for Sustainable Cities. Architectural Press, Elsevier, Oxford, UK

Section B

DECLARATION BY CANDIDATE (delete as appropriate)

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(ii) joint author

~~(iii)~~ **minor contributing author**

Signed: Geo H O'Brien (candidate) 1/11/07 (date)

Section C

STATEMENT BY CO-AUTHOR (delete as appropriate)

Either **(i) I agree with the above declaration by the candidate**

~~**or (ii) I do not agree with the above declaration by the candidate for the following reason(s):**~~

Signed: Bob Giddings (co-author) 12 Dec 2007 (date)

northumbria UNIVERSITY

DECLARATION OF CO-AUTHORSHIP OF PUBLISHED WORK

(Please use one form per co-author per publication)

Section A

Name of candidate: **Geoff O'Brien**

Name of co-author: **Bill Hopwood**

Full bibliographical details of the publication (including authors):

Giddings, R., Hopwood, W., Mellor, M., O'Brien, G., 2005 Back to the City: A route to urban sustainability. In Jenks M, Dempsey N (eds) Future Forms and Design for Sustainable Cities. Architectural Press, Elsevier, Oxford, UK

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~~(iii)~~ **minor contributing author**

Signed: Geoff O'Brien (candidate) 1/4/07 (date)

Section C

STATEMENT BY CO-AUTHOR (delete as appropriate)

Either **(i) I agree with the above declaration by the candidate**

or **(ii)** ~~**I do not agree with the above declaration by the candidate for**~~ **the following** ~~**reason(s):**~~

Signed: Bill Hopwood (co-author) Dec. 13 '07 (date)

northumbria UNIVERSITY

DECLARATION OF CO-AUTHORSHIP OF PUBLISHED WORK

(Please use one form per co-author per publication)

Section A

Name of candidate: **Geoff O'Brien**

Name of co-author: **Bill Hopwood**

Full bibliographical details of the publication (including authors):

Hopwood B. Mellor M. O'Brien G.. 2005, Sustainable Development: Mapping Different Approaches, Sustainable Development (13) pp38-52. John Wiley & Sons and ERP Environment

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Section C

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Section C

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Signed: Bill Hopwood (co-author) Dec 13 '07 (date)

northumbria UNIVERSITY

DECLARATION OF CO-AUTHORSHIP OF PUBLISHED WORK

(Please use one form per co-author per publication)

Section A

Name of candidate: **Geoff O'Brien**

Name of co-author: **Joanne Rose**

Full bibliographical details of the publication (including authors)**:**

O'Brien G. O'Keefe P. Rose J., 2007, Energy, Poverty and Governance, The International Journal of Environmental Studies, vol 64 no. 5 pp607-618. Routledge

Section B

DECLARATION BY CANDIDATE (delete as appropriate)

I declare that my contribution to the above publication was as:

(i) **principal author**

(ii) **joint author**

(iii) **minor contributing author**

Signed: Geoff O'Brien (candidate) 1/11/07 (date)

Section C

STATEMENT BY CO-AUTHOR (delete as appropriate)

Either **(i)** **I agree with the above declaration by the candidate**

or **(ii)** **I do not agree with the above declaration by the candidate for the following reason(s):**

Signed: J. Rose (co-author) 18/12/07 (date)

northumbria UNIVERSITY

DECLARATION OF CO-AUTHORSHIP OF PUBLISHED WORK

(Please use one form per co-author per publication)

Section A

Name of candidate: **Geoff O'Brien**

Name of co-author: **Joanne Rose**

Full bibliographical details of the publication (including authors)**:**

O'Brien G. O'Keefe P. Rose J. Wisner B., 2006, Climate Change and Disaster Management, Disasters 30(1):64-80. Blackwell

Section B

DECLARATION BY CANDIDATE (delete as appropriate)

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~~(i)~~ **principal author**

(ii) joint author

~~(iii)~~ **minor contributing author**

Signed: Geoff O'Brien (candidate) 1/11/07 (date)

Section C

STATEMENT BY CO-AUTHOR (delete as appropriate)

Either **(i)** **I agree with the above declaration by the candidate**

or **(ii)** **I do not agree with the above declaration by the candidate for the following reason(s):**

Signed: .....(co-author) 18/12/07 (date)

northumbria UNIVERSITY

DECLARATION OF CO-AUTHORSHIP OF PUBLISHED WORK

(Please use one form per co-author per publication)

Section A

Name of candidate: **Geoff O'Brien**

Name of co-author: **Phil O'Keefe**

Full bibliographical details of the publication (including authors)**:**

O'Brien G. O'Keefe P., 2006, The Future of Nuclear Power in Europe: A Response, the International Journal of Environmental Studies, Vol 63 No 2 pp 121-130

Section B

DECLARATION BY CANDIDATE (delete as appropriate)

I declare that my contribution to the above publication was as:

(i) **principal author**

~~**(ii)**~~ **joint author**

~~**(iii)**~~ **minor contributing author**

Signed: Geoff O'Brien/ (candidate) 1/11/07 (date)

Section C

STATEMENT BY CO-AUTHOR (delete as appropriate)

Either **(i)** **I agree with the above declaration by the candidate**

or **(ii)** **I do not agree with the above declaration by the candidate for the following reason(s):**

Signed: Phil O'Keefe (co-author) 12/12/07 (date)

northumbria UNIVERSITY

DECLARATION OF CO-AUTHORSHIP OF PUBLISHED WORK

(Please use one form per co-author per publication)

Section A

Name of candidate: **Geoff O'Brien**

Name of co-author: **Phil O'Keefe**

Full bibliographical details of the publication (including authors):

O'Brien G. O'Keefe P. Rose J. Wisner B., 2006, Climate Change and Disaster Management, Disasters 30(1):64-80. Blackwell

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DECLARATION BY CANDIDATE (delete as appropriate)

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~~(iii)~~ **minor contributing author**

Signed: Geoff O'Brien (candidate) 1/11/07 (date)

Section C

STATEMENT BY CO-AUTHOR (delete as appropriate)

Either **(i)** **I agree with the above declaration by the candidate**

or **(ii)** **I do not agree with the above declaration by the candidate for the following reason(s):**

Signed: Phil O'Keefe (co-author) 12/12/07 (date)

northumbria UNIVERSITY

DECLARATION OF CO-AUTHORSHIP OF PUBLISHED WORK

(Please use one form per co-author per publication)

Section A

Name of candidate: **Geoff O'Brien**

Name of co-author: **Phil O'Keefe**

Full bibliographical details of the publication (including authors):

O'Brien G. O'Keefe P. Rose J., 2007, Energy, Poverty and Governance, The International Journal of Environmental Studies, vol 64 no. 5 pp607-618. Routledge

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~~(iii)~~ **minor contributing author**

Signed: Geoff O'Brien (candidate) 1/11/07 (date)

Section C

STATEMENT BY CO-AUTHOR (delete as appropriate)

Either **(i)** **I agree with the above declaration by the candidate**

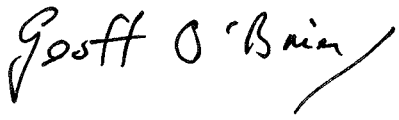
or **(ii)** **I do not agree with the above declaration by the candidate for the following reason(s):**

Signed: Phil O'Keefe (co-author) 12/12/07 (date)

Declaration

I declare that the work contained in this submission has not been submitted for any other award, from this, or any other, institution.

Name: Geoff O'Brien

Signature: 

Date: 1st October 2008